

Neotropical Emerald moths of the
genera *Nemoria*, *Lissochlora* and
Chavarriella, with particular
reference to the species of Costa
Rica (Lepidoptera: Geometridae,
Geometrinae)

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SYNOPSIS. The classification of the Neotropical species of the New World genus *Nemoria* Hübner (Geometridae: Geometrinae) is reviewed and species previously assigned to its junior synonym *Racheospila* Guenée are transferred to *Nemoria* and to various other genera. *Lissochlora* Warren is recalled from synonymy with *Racheospila*, and two genera (*Leptographa* Hübner and *Dryadopsis* Warren) are newly synonymized with *Nemoria*. One genus (*Chavarriella*) and 25 species of *Nemoria* and *Lissochlora* (one Mexican and 24 in Costa Rica) are described as new. Other changes established in this work include 32 species synonyms and 149 new combinations. The Costa Rican species (58 of the 155 species studied) of *Nemoria*, *Chavarriella* and *Lissochlora* are revised and keys, based on external features, are provided for their identification. External features and genitalia of each of these species are illustrated and a colour plate shows representative species in life. All other known Neotropical species of these genera are catalogued.

INTRODUCTION

The rich biodiversity of tropical forests and other wildlands can be conserved and saved for the future if this biodiversity is treated as a sustainable resource (see Janzen, 1993; Gamez & Gauld, 1993). These authors describe the need for an inventory that will provide accurate taxonomic information. Such information is the groundwork on which further biological studies are based, enabling investigation to be made into ways of using resources without destroying biodiversity. Costa Rica's well-established system of conserved lands, which supports a rich fauna and flora, has been at the forefront of this exciting new approach.

This study is one of a series of contributions of the geometrid moth research group at the Natural History Museum, London, the efforts of which have been encouraged by association with Dr Daniel Janzen, University of Pennsylvania, U.S.A., and with the Instituto Nacional de Biodiversidad (INBio), Costa Rica. A significant component of the material used in this work was collected by Costa Rican parataxonomists, who are undertaking extensive sampling of the fauna and flora of Costa Rica.

Most Geometrinae are attractive, slender-bodied, delicate moths popularly known as Emeralds or Greens on account of the rich shade of green prevalent in the group. The green pigment has recently been investigated by Cook (1993). Those Geometrinae that are vivid green, such as *Nemoria* Hübner and its relatives, retain their bright hue for decades, perhaps even indefinitely in Museum collections, providing specimens remain dry. This is not always the case if these specimens are exposed to moisture. The 'green death' study by Dr John Rawlins and his team at the Carnegie Museum, Pittsburgh,

U.S.A. (pers. comm.) has shown that although the green colour of recently collected specimens is unaffected by moisture, specimens that have been dried for more than three or four years become discoloured if they are exposed to water-saturated air. Certain geometrine groups, such as most of the Hemitheini, are duller in colour and dried specimens are subject to fading.

The Geometrinae are particularly diverse in the tropics and the majority of species of *Nemoria* and all of those in *Lissochlora* Warren and *Chavarriella* gen. n. are Neotropical. A daytime walk through a tropical forest reveals next to nothing of these moths or their cryptic, leaf-eating caterpillars and even at night, when the moths are active, relatively few are seen at light. Their diversity is apparent only after many sessions of light-collecting.

There are few modern taxonomic revisions of Neotropical Geometrinae. Such revisions are essential for two reasons: firstly, the current state of taxonomy is in many cases an inaccurate representation of the situation in nature; secondly, there is a need for specimens to be accurately identified. *Nemoria* was specially selected for review because it represents the largest and, arguably, the most taxonomically involved group of Neotropical geometrines. This study is also intended to complement the work on the North American species of *Nemoria* by Ferguson (1985). Together with the study of the genus *Oospila* Warren, by Cook (1993), approximately half of the Neotropical species of Geometrinae have been covered taxonomically.

In sorting out the problems in *Nemoria* it was necessary to deal with the numerous species that had been combined with *Racheospila* Guenée, and whose correct generic placement has remained uncertain since that genus was synonymized with *Nemoria*. In the present study 181 species are recognised. Of these, 14 are assigned

to a new genus, *Chavarriella*, 42 to *Lissochlora*, which is recalled from synonymy with *Nemoria*, and 25 are added to those already placed in *Synchlora* Guenée, another geometrine genus dealt with in part by Ferguson (1985). In addition to the 35 North American species of *Nemoria* covered by Ferguson, 99 species are recognised in this work. Only seven of the 180 species covered by my study retain the same binomen as before. This study has redefines and delimits species, and provides a means of identifying those in Costa Rica (about 60 species). It is possible to distinguish nearly all of them on external features alone.

A full revision of *Nemoria*, *Lissochlora* and *Chavarriella* is beyond the scope of the present study but the Costa Rican species are fully revised. This revision has necessitated examination and reassessment not just of that country's species but of all the described Neotropical species in these genera. Detailed re-examination of the North American species, revised by Ferguson (1985), proved unnecessary. In general, I have not described new species other than those from Costa Rica. The one exception is a species from Nearctic Mexico which I have described because it is closely related to two new species in Costa Rica. Despite intense sampling in recent years in Costa Rica, further species probably remain to be discovered even in that country.

MATERIAL AND METHODS (see also 'Taxonomic characters')

This study is based on more than 2000 specimens of *Nemoria*, *Lissochlora* and *Chavarriella*, examined from three main sources: the collections of The Natural History Museum, London, U.K. (BMNH) (primary types and large series of other Neotropical material), the National Museum of Natural History, Washington D.C., U.S.A. (USNM) (further primary types), and the Instituto Nacional de Biodiversidad, San José, Costa Rica (INBio) (extensive, recently collected, Costa Rican material). The bulk of the material from INBio was collected by Daniel Janzen, Winnie Hallwachs, and INBio's team of parataxonomists. The majority of the 25 species newly described are based on holotypes deposited in INBio. Voucher specimens have been retained, when material was adequate, in the BMNH.

I examined about 470 genitalia slides, most of which were prepared specifically for this work. Since abdominal markings are of great diagnostic

value in this group, I made notes on these, and sometimes photographed them, before removing the abdomen for dissection. Because structures around the ostium in the female genitalia are often fused with abdominal sternite 7, this sternite was not removed with the anterior abdominal segments. However, the removal of tergite 7 was found to result in clearer photographs of the genitalia even though this sclerite lies beneath the genitalia in conventional (i.e. ventrally viewed) slide preparations. The black-and-white photographs of whole moths are all to the same scale; other illustrations are not to the same scale.

I have followed the convention of describing features of the male abdominal segment 8 under the heading 'GENITALIA', although they are pregenital structures.

Characters given in the diagnoses distinguish Costa Rican species from each other and usually, but not necessarily always, from all other previously named species. However, all new species are exclusively diagnosed. Also, differences between Costa Rican species and close relatives from other countries are usually noted.

Lectotypes were designated where necessary, particularly since several species have mixed syntype-series. In selecting lectotypes, specimens were chosen that had already been labelled as the 'Type' in the collections of the BMNH and the USNM except in a few instances where these proved unsuitable.

In addition to *The Times Atlas of the World* (Comprehensive Edn, 1968), Appendix I in Brown (1979) proved invaluable for checking locality names and I have followed his order of countries in listing distributions and material examined.

DEPOSITORIES OF MATERIAL

- BMNH The Natural History Museum, London, U.K. (formerly British Museum (Natural History)).
- CMNH Carnegie Museum, Pittsburgh, U.S.A.
- CVCJ Charles Van Orden Covell, Jr., collection, U.S.A.
- CU Cornell University, Ithaca, N.Y., U.S.A.
- HERB Herbulot collection, France.
- INBio Instituto Nacional de Biodiversidad, San José, Costa Rica
- MNHU Museum für Naturkunde der Humboldt-Universität, Berlin, Germany.
- NM Naturhistorisches Museum, Vienna, Austria.
- RNHL Rijksmuseum van Natuurlijke Historie, Leiden.

- SMF Forschungsinstitut Senckenburg, Frankfurt-am-Main, Germany.
 UCB University of California, Berkeley, U.S.A.
 USNM National Museum of Natural History, Washington, D.C., U.S.A. (formerly United States National Museum, USNM).

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The black-and-white photographs were taken by the Photographic Unit, BMNH.

TAXONOMIC CHARACTERS

External features

Species of *Chavarriella* may be distinguished by the shape and colour of the blotches on the wings but interspecific variation in wing markings in *Nemoria* and *Lissochlora* is often more subtle. However, some differences exist even between many of the almost plain-winged species. The form of the postmedial lines (such as waved or smooth, complete or broken) in particular, is frequently sufficiently constant for purposes of identification. Other distinguishing features, which are of value when not subject to intraspecific variation, are the colour of the front and dorsal area of the head, and the presence or absence of a white band between the antennae (the interantennal fillet). However, often the most useful diagnostic characters are the dorsal spots on the abdomen. Commonly these are three in number (sometimes more), and white, typically surrounded by a reddish brown ring. Sometimes they take the form of one or two dark brown spots or other markings (Figs 70–82).

Most of these moths are of medium size for Geometrinae though certain species exhibit considerable individual variation. Size is likely to be of diagnostic value only for species that are consistently large or small and size ranges are given in such cases.

Wing venation (Figs 68, 69)

The venation of *Nemoria*, *Lissochlora* and *Chavarriella* is clearly visible when viewed against a light source because these moths have delicate, thinly scaled wings. Making slide preparations of the wings is, therefore, largely unnecessary. Whether the hind wing veins M3 and Cu1 have a common stalk for part of their length, are separate throughout their lengths, or are just approximated can be diagnostic. However, variation within species is common.

Genitalia

The terminology of the genitalia largely follows that of Klots (1956) and Ferguson (1985); various male structures are labelled in Figs 139 and 140.

Marked differences between species are seen in the genitalia of *Nemoria* and *Lissochlora* and their examination will permit reliable identification of nearly any specimen, male or female. In males, sometimes enough of the tip of the uncus and the valvae is visible to enable identification without dissection, particularly in species with a long basal process of the valva such as in *marielosae*. It is possible to use a fine paintbrush to brush away some of the hair-like tufts that tend to obscure the end of the abdomen but great care must be taken to avoid breaking delicate or brittle structures in dried specimens.

Species differ in the length and shape of the uncus and socii, and in the juxta, which often has a papilla. The shape of the valva, and its basal and costal processes where present, varies from simple to highly modified and intricate. The length of the valva in comparison with the basal costal process is measured from the point where this process arises from the valva. Coremata are often present at the base of the valva, towards the saccus. The aedeagus lacks cornuti but some species have an external row of fine spines. A semi-rigid structure, probably derived from the anellus, is fused with the aedeagus. It is well developed and distinctive in some species but highly variable, and thus of limited taxonomic value, in others. I term this structure as the anellar plate (Fig. 140) since it is a sclerotization of the anellus, that area of the diaphragma lying between the transtilla in the dorsal region of the diaphragma (the fultura superior) and the juxta in the ventral region (the fultura inferior). The depth of the notch in the posterior margin of sternite 7 of the male abdomen is also diagnostic. The two lobes formed as a result of this emargination are usually rounded but occasionally strongly pointed. In the female, characters of the

ostial region and sternite 7 are of prime diagnostic importance, especially the form of the semi-sclerotized pouch, often present, connecting the ostium and sternite.

Differences between species within *Nemoria* and *Lissochlora* are usually distinct, whereas they are not in *Chavarriella*, where the genitalia are uniformly simple. However, marked intraspecific variation occurs in a few species and the taxonomy of a few species-complexes and forms has yet to be resolved.

INTRASPECIFIC VARIATION

Individual and geographic variation

The wing markings vary to some extent within *Chavarriella* species, particularly in *C. fallax*. This species has a narrow blotched form confined to Costa Rica, whereas the typical form, which also occurs in Costa Rica, is more widespread. In *Nemoria aturia* and *N. scriptaria* which are widely distributed patterned-winged species, those moths at the south-eastern end of the range are more heavily marked. Variation in abdominal markings occurs in *N. pescadora* in which Costa Rican populations lack the spots present in Mexican specimens. Some variation, mainly individual rather than geographical, is seen in the size of the abdominal spots of certain other species.

Although generally reliable and subject only to minor variation within species, the valva in *Nemoria* and *Lissochlora* varies considerably intraspecifically in a few cases, notably in *N. dentilinea*, where the distal costal process ranges from short to extremely long. The variation in *dentilinea* is approximately related to the geographic range of the species, individuals with the shortest processes occurring at the northwestern end of the range (Costa Rica) and individuals with intermediate and long processes occurring in South America. Other instances of geographic variation in the male genitalia, mainly in the processes of the valva, are seen in *N. venezuelae* and *N. callirrhoe*, in which the Costa Rican forms are provisionally regarded as conspecific with those in South America. Each of the two species of the *pacificaria*-group in *Nemoria* has at least two geographic forms showing small differences in genital features in both sexes.

Certain external and genitalic features (particularly the wing markings and the basal costal process of the valva) are highly variable in the high-elevation species *N. vinocincta* and *N.*

strigaria, and this variation is approximately related to altitude in *vinocincta*.

Seasonal variation

No seasonal variation is known in the tropical species of *Nemoria* and related genera but Ferguson (1985) describes brown seasonal forms in broods of several species in the U.S.A., particularly in the South. Spectacular seasonal dimorphism in the larvae of the southern nearctic species *N. arizonaria* (Grote), is described by Greene (1989) (see under *Nemoria* biological notes). The spring brood develop as catkin mimics whereas the summer brood are twig mimics.

Sexual dimorphism

Sexual dimorphism of the antennae (bipectinate in the male and simple in the female) is standard in *Nemoria*, *Lissochlora* and *Chavarriella*, with the exception of *N. winniae*. Female moths are slightly larger than males on average and lack the strong dilation and apical extension seen in the male hind tibia. However, there are few examples of marked sexual dimorphism. *N. vermiculata* is notable for the different wing and abdominal markings between the sexes, and differences in the number and size of the abdominal spots occur in *N. punctilinea* and a few other species.

THE SYSTEMATIC POSITION OF *NEMORIA* AND RELATED GENERA

The concept of *Nemoria* has undergone enormous change since the studies of Prout (1912, 1932) and earlier authors. Prout had an excellent eye for the subtle distinctions between these predominantly plain green moths, but his observations were based solely on external characters whereas the taxonomy can only be resolved satisfactorily if the genitalia are also studied.

Nemoria included only 26 species, all from North America or Nearctic Mexico, in Prout's 1932 treatment, while the Neotropical species, which make up the bulk of the genus in the present study, were placed in *Racheospila* at that time. Prout recognised that the classification was not entirely satisfactory but the synonymy of the two genera was deferred until Forbes' (1948) study of certain North American species. Ferguson (1969 and 1985) revised the North American species, assigning some *Racheospila* species to

Synchlora and others to *Nemoria*, which was by then augmented to 35 species north of Mexico plus a few Neotropical species. Ferguson wisely did not deal with Neotropical '*Racheospila*'. As he suspected, a large number of species belong in *Nemoria* but many others must be excluded from that genus. Certain species are transferred to *Synchlora* and other genera in the present work.

Ferguson (1985) pointed out that the basal costal process of the male valva is highly characteristic of *Nemoria* and I consider that the distinct development of this structure is the strongest apomorphy of the genus, based on data currently available. I have included in *Nemoria* a few species with a rather weak process (eg *dorsilinea*) and this process is weak also in one or two species in Ferguson's concept of the genus; the placement of such species is expedient for the present but may warrant further investigation. I have been able to resolve problems with two groups of '*Racheospila*' species with slight or no development of a basal process by placing them in two other genera, *Chavarriella* and *Lissochlora*.

Prout (1912, 1932) assigned a group of species with characteristic markings on the wing and abdomen to the *lafayaria*-group of *Racheospila*. I am placing most of this group in a new genus, *Chavarriella*, which is defined by the autapomorphy, the small brown tuft on the second pale abdominal spot. A distinguishing character, the absence of a basal costal process of the male valva, is plesiomorphic. Several other members of Prout's *lafayaria*-group, including *interlucens* and *vermiculata* in Costa Rica, belong in *Nemoria*; one additional species, *urania*, recently described in *Nemoria*, is here transferred to *Chavarriella*.

Lissochlora was synonymized with *Racheospila* by Prout who treated the species collectively as the *diarita*-group of that genus. I reinstate *Lissochlora* as a genus which, though diverse, is defined by the autapomorphy, the slight projection or kink of the aedeagus; it is also characterized by the form of the female antrum. I place the majority of Prout's *diarita*-group in *Lissochlora* but a few species, including the Costa Rican *dorsilinea*, are better assigned to *Nemoria*. Several species of Prout's *albociliaria*-group in *Racheospila* appear to be closely related to *Lissochlora* species from his *diarita*-group and these are also transferred to *Lissochlora*. Several other *albociliaria*-group species, including *albociliaria* itself, are less closely related to those in the *diarita*-group but are accommodated as a separate group within *Lissochlora*. Certain other species in Prout's *albociliaria*-group are assigned to

Nemoria. Many of the remaining '*Racheospila*' species belong in *Nemoria*, contributing substantially to its current total of 134 species, and I have synonymized two other genera with *Nemoria*: *Dryadopsis* Warren and *Leptographa* Hübner.

The North American Geometrinae were divided into five tribes by Ferguson (1969) who placed *Nemoria*, *Chlorosea* Packard, *Phrudocentra* Warren and *Dichorda* Warren in the Nemoriini. I now add the solely Neotropical genera *Chavarriella*, *Lissochlora*, *Paromphacodes* Warren, and *Rhodochlora* Warren to this group. The three genera in the present study, *Nemoria*, *Lissochlora* and *Chavarriella*, do not constitute a monophyletic subgroup of the Nemoriini.

Chlorosea and *Chavarriella* have similar genitalia to those of *Nemoria*, but they lack the development of the basal costal process of the male valva. In *Lissochlora* and *Nemoria*, the valva has a differentiated, sclerotized costal region, usually with some development of processes. *Paromphacodes* has a small basal costal process and may prove to be congeneric with *Nemoria* but further investigation is required. *Rhodochlora* also has a slight basal costal process. Similar structures in two species of *Prohydata* Schaus (not a nemoriine genus), *povera* Schaus and *propinqua* Prout are considered to be independently derived. *Phrudocentra* is defined chiefly by the pear-shaped structure of the male tegumen and vinculum whereas these, together with the uncus, are spindle-shaped in *Dichorda*. *Lissochlora* has a broadened or otherwise modified costal side of the male valva, and the uncus is strongly modified in the *albociliaria*-group.

Ferguson (1969 and 1985) assigned *Synchlora* and *Cheteoscelis* Prout to the Synchlorini and gave detailed diagnoses of that tribe and the Nemorini. In 1985 he stated that he would have included the Synchlorini in the Nemoriini were it not for differences in genitalia, venation and larval behaviour. Study of the Neotropical species of *Nemoria*, *Lissochlora* and *Chavarriella* has shown that the Nemoriini have a much greater diversity of genitalic features than in Ferguson's concept of the tribe, based solely on the Nearctic fauna. As a result, the differences between the genitalia of Synchloriini and the Nemoriini appear insufficient to justify separate tribal status. As Ferguson stated (1985: 14 and 80), the larval behaviour characteristic in all instars of Synchlorini is seen in some Nemoriini in the first instar. One venation character of the Synchlorini, the fusion of the hind wing veins Sc+R1 and Rs, does not apply in all cases; these veins are not fused in *S. tenuimargo* for instance.

I am dubious of the distinction of the two

tribes on the basis of the differences shown to date but defer formal synonymy in the absence of any information on the early stages of *S. despicata*, *Lissochlora* and *Chavarriella*. Certain other Neotropical genera might also be better placed in the *Nemoriini* but further resolution of the relationships between the New World genera of Geometrinae is beyond the scope of the present study.

SPECIES-GROUPS

Certain groupings of species are apparent within the large genus *Nemoria* (134 species) and also within *Lissochlora*. These species-groups are here treated as monophyletic, although many species are left over which do not fall readily into any group or which are insufficiently studied. I have established several new species-groups and modified a few existing ones, defined by characters here regarded as autapomorphies.

The *albociliaria*-group and the *diarita*-group, both now in *Lissochlora*, were used by Prout as subdivisions of *Racheospila* (see above). I have retained the group-names but some of their component species have changed. The *albociliaria*-group is characterized by the broad, tapering, hood-like uncus (Figs 142–145), and the *diarita*-group by the weakly curved outer margins of the wings, almost straight in the fore wing, which has a sharp apex (Figs 10–13). The secondary loss of the signum is a likely further autapomorphy for the latter group.

Prout's *pacificaria*-group, which is transferred from *Racheospila* to *Nemoria*, is reduced from 12 species to two that have very similar processes of the valva. The small distal process of the valva is spinose, with a hair-like tuft (Figs 173–178).

The *scriptaria*-group is also now in *Nemoria*. Based on Prout's *exertata*-group, with a few changes, it is renamed because *exertata* is a synonym of *scriptaria*. This group has a whorl of brown speckles around the discal spot of the fore wing (Figs 14–16, 19, 42). The development of a deep posterior notch, between distinctly projecting tapered lobes, of sternite 8 in the male is transitional within the group and it is not clear whether it is an autapomorphy of the entire group or merely of a subgroup of species. This development (Figs 98–103) ranges from slight (not significantly more than that of species outside the group) to the extremely deep notch seen in some specimens of *aturia*.

In synonymizing *Dryadopsis* with *Nemoria*, I

have kept most of its species together (except for the type-species) and I refer to them, along with some additional species, as the *pulveraria*-group. This group is characterized by the striated costa of the fore wing (Figs 17, 18, 20–23), and by the short antennal branches of the male. The paired folds or pouches in the ostial region of the female (Figs 290, 291) may be a further autapomorphy.

The following groups are newly recognised in *Nemoria*. The *erina*-group have an ovoid core-matal sac (Figs 155, 156) in addition to the usual long sac.

The two species of the *strigaria*-group have a narrow curved valva with a tongue-like distal process (Figs 163–164). Occasionally the distal process is secondarily lost in *strigaria*.

The *gladysae*-group has a long narrow valva with a blade-like process at the extreme tip (Figs 166, 167), rather than subapically as is usual.

The *cosmeta*-group has a long spinulose, rod-like basal costal process of the valva (Figs 168–172). A subgroup of the *cosmeta*-group consists of three species (*lorenae*, *marielosae* and *sarukhani*) that have a median process of the aedeagus (Figs 237–239).

CHECKLIST OF THE NEOTROPICAL SPECIES OF *NEMORIA*, *LISSOCHLORA* AND *CHAVARRIELLA*

CHAVARRIELLA gen. n.

- brunneilinea* (Prout, 1912) **comb. n.**
- semiornata* ab. *brunneilinea* (Warren, 1907) [infrasubspecific name]
- excelsa* (Dognin, 1910) **comb. n.**
- fallax* (Warren, 1907) **comb. n.**
- distinguenda* (Dognin, 1923) **syn. n.**
- fallax allotaxis* (Prout, 1932) **syn. n.**
- fallax cohibita* (Prout, 1932) **syn. n.**
- lafayaria lafayaria* (Dognin, 1892) **comb. n.**
- lafayaria promontoria* (Warren, 1904a) **comb. n.**
- promontoria dilata* (Prout, 1916) **syn. n.**
- lugentiscripta lugentiscripta* (Prout, 1917a) **comb. n.**
- lugentiscripta dubia* (Prout, 1917a) **comb. n.**
- luteifimbria* (Dognin, 1901) **comb. n.**
- pelops* (Prout, 1932) **comb. n.**
- porcius* (Schaus, 1912a) **comb. n.**
- psittacina* (Prout, 1910) **comb. n.**
- semiornata* (Warren, 1901) **comb. n.**
- spasma* (Dognin, 1923) **syn. n.**
- diminuta* (Dognin, 1923) **syn. n.**
- semiornata abornata* (Prout, 1932) **syn. n.**
- spasma oroyana* (Prout, 1932) **syn. n.**
- sophrosyne* (Prout, 1932) **comb. n.**

syncrasis (Prout, 1912) **comb. n.**
conflua (Warren, 1904b) [junior homonym]
trianteris (Prout, 1932) **comb. n.**
urania (Herbulot, 1988b) **comb. n.**

LISSOCHLORA Warren, 1900 **gen. rev.**

albociliaria-group

albociliaria (Herrich-Schäffer, 1855) **comb. n.**
dubiaria (Oberthür, 1916) **syn. n.**
inconspicua (Bastelberger, 1911) **comb. n.**
manostigma (Dyar, 1912) **comb. n.**
paegnina (Prout, 1932) **comb. n.**, **stat. n.**
pectinifera (Prout, 1916) **comb. n.**
purpureotincta (Warren, 1900) **comb. n.**
purpureoviridis (Warren, 1904a)
quotidiana (Prout, 1932) **comb. n.**

diarita-group

bryata (Felder & Rogenhofer, 1875) **comb. n.**
flavifimbria (Warren, 1897) **syn. n.**
iguala (Dognin, 1898) **syn. n.**
albifimbriata Dognin, 1913 **syn. n.**
bryata resurgens (Prout, 1932) **syn. n.**
cecilia (Prout, 1912) **comb. n.**
carmen (Prout, 1916) **syn. n.**
montana (Prout, 1916) **syn. n.**
montana tenuilinea (Prout, 1916) [junior homonym]
montana smaragdina (Prout, 1916) **syn. n.**
montana araeomita (Prout, 1932) **syn. n.**

daniloi sp. n.

diarita (Dognin, 1898) **comb. n.**
eugethes (Prout, 1912) **comb. n.**
neodmes (Prout, 1916) **syn. n.**

freddyi sp. n.

latuta (Dognin, 1898) **comb. n.**
ella (Prout, 1912) **syn. n.**
mollissima (Dognin, 1892) **comb. n.**
nigricornis Warren, 1907 **comb. rev.**
nortia (Druce, 1892) **comb. rev.**
pasama (Dognin, 1898) **comb. n.**
ronaldi sp. n.

viridifimbria Dognin, 1911b **comb. rev.**
viridilinea viridilinea (Prout, 1916) **comb. n.**
viridilinea cushiensis (Prout, 1932) **comb. n.**
vividata (Prout, 1932) **comb. n.**

Other species in the genus

alboseriata (Warren, 1900) **sp. rev.**
dispilata (Dognin, 1914) **syn. n.**
calida (Dognin, 1898) **comb. n.**
discipuncta (Warren, 1900) **comb. n.**
hena (Dognin, 1898) **comb. n.**
plenifimbria (Dognin, 1910) **syn. n.**
hena ab. duplex (Prout, 1932) [infrasubspecific name]
hoffmannsi (Prout, 1932) **comb. n.**
jenna jenna (Dognin, 1898) **comb. n.**
jenna salubris (Prout, 1932) **comb. n.**
jocularia (Dognin, 1923) **comb. n.**
licada (Dognin, 1898) **comb. n.**
liriata (Dognin, 1898) **comb. n.**
molliculata (Warren, 1904a) **comb. n.**
monospilonota (Prout, 1916) **comb. n.**
multiseriata (Dognin, 1923) **comb. n.**

nigripes (Dognin, 1911a) **comb. n.**
punctiseriata (Dognin, 1910) **comb. n.**
florifera (Prout, 1910) **syn. n.**
rhodonota (Prout, 1916) **comb. n.**
rufiguttata (Warren, 1900) **comb. n.**
rufipicta (Prout, 1910) **comb. n.**
rufoseriata (Prout, 1917b) **comb. n.**
stacta (Prout, 1932) **comb. n.**
venilineata Warren, 1907 **comb. rev.**

NEMORIA Hübner, 1818

Leptographa Hübner, [1823] **syn. n.**
Racheospila Guenée, 1857
Aplodes Guenée, 1857
Hipparchiscus Walsh, 1864
Anaplodes Packard, 1876
Annemoria Packard, 1876
Blechroma Möschler, 1881
Miantonota Warren, 1895
Dryadopsis Warren, 1897 **syn. n.**

pulveraria-group

adjunctaria (Dyar, 1914) **comb. n.**
leucaspis (Prout, 1932) **syn. n.**
anae sp. n.
characta (Prout, 1932) **comb. n.**
epaphras (Schaus, 1912a) **comb. n.**
eugeniae sp. n.
pulveraria (Schaus, 1901a) **comb. n.**
tickelli sp. n.

erina-group

erina (Dognin, 1896) **comb. n.**
erina ab. bipunctata (Dognin, 1908) [infrasubspecific name]
parcipuncta (Dognin, 1908b) **comb. n.**
punctilinea (Dognin, 1902) **comb. n.**
spatha (Debauche, 1937) **comb. n.**
unipunctata (Prout, 1912) **comb. n.**, **stat. rev.**
erina ab. disjuncta (Warren, 1909) [infrasubspecific name]
disjuncta (Prout, 1932) **syn. n.**

scriptaria-group

aturia aturia (Druce, 1892) **comb. n.**
puntillada (Dognin, 1893) **syn. n.**
tisstigmata (Dyar, 1912) **syn. n.**
magnidiscata (Prout, 1912)
aturia scotocephala (Prout, 1916) **comb. n.**
conflua (Warren, 1904b) **comb. n.**
consersa (Warren, 1904b) **comb. n.**
elbae sp. n.
hazela sp. n.
hypotiches (Prout, 1932) **comb. n.**
nigricincta nigricincta (Warren, 1904b) **comb. n.**
nigricincta fassli (Prout, 1932) **comb. n.**
nigricincta ligata (Debauche, 1937) **comb. n.**
oppleta (Warren, 1907) **comb. n.**
ozalea (Prout, 1932) **comb. n.**
penthica (Prout, 1917a) **comb. n.**
pulverata (Dognin, 1914) **comb. n.**
scriptaria (Hübner, [1823]) **comb. n.**
viridaria (Stoll, [1790]) [junior homonym]
exertata (Möschler, 1881) **syn. n.**
radiolinea (Prout, 1916) **syn. n.**
spurca Herbulot, 1982

strigaria-group
saryae sp. n.
strigaria (Schaus, 1912a) comb. n.
gladysae-group
franciscas sp. n.
gladysae sp. n.
cosmeta-group
cosmeta (Prout, 1912)
decorata (Warren, 1904a) [junior homonym]
imitans (Warren, 1907) sp. rev.
imitans ab. *versiplaga* (Dognin, 1911b) [infra-specific name]
integra (Warren, 1897) comb. n.
karlae sp. n.
lorenae sp. n.
marielosae sp. n.
sarukhani sp. n. (Nearctic Mexico)
pacificaria-group
pacificaria (Möschler, 1881) comb. n.
tutala (Dognin, 1898) comb. n.
other species in the genus
acora (Dognin, 1898) comb. n.
acutularia (Schaus, 1912a) comb. n.
thymele (Prout, 1932) syn. n.
adaluzae sp. n.
agenoria (Schaus, 1912a) comb. n., sp. rev.
albilineata (Warren, 1909) comb. n.
anchistrophe (Prout, 1932) comb. n.
antipala (Prout, 1932) comb. n.
antipala purifimbria (Prout, 1932) syn. n.
astraea (Druce, 1892) comb. n.
callirrhoe (Prout, 1932) comb. n.
capys (Druce, 1892)
capysoides (Schaus, 1901)
cara (Dyar, 1918) comb. n.
carbina (Druce, 1892) comb. n.
carolinae sp. n.
consimilis (Warren, 1909) comb. n.
defectiva (Prout, 1932) comb. n., stat. n.
delicataria Möschler, 1881
dentilinea dentilinea (Warren, 1897) comb. n.
dentilinea paurocaula (Prout, 1932) comb. n.
dentilinea tenuilinea (Kaye, 1901) comb. n.
dorsilinea (Schaus, 1912) comb. n.
duniae sp. n.
florae sp. n.
fontalis (Warren, 1909) comb. n.
gerardinae sp. n.
gortaria (Schaus, 1901) comb. n.
haematospila (Prout, 1912) comb. n.
inaequalis (Prout, 1917a) comb. n.
incognita (Warren, 1900) comb. n.
interlucens (Schaus, 1912) comb. n.
isabelae sp. n.
latimarginaria (Maassen, 1890) comb. n.
marianellae sp. n.
modesta (Dognin, 1911a) comb. n.
morbiliata (Felder & Rogenhofer, 1875) comb. n.
mustela (Druce, 1892)
nigrisquama (Dognin, 1904) comb. n.
nympharia (Schaus, 1912) comb. n.
parvipuncta (Warren, 1900) comb. n.
aperuviana (Prout, 1916) comb. n., stat. n.

pescadora Beutelspacher, 1984 comb. n.
prava (Prout, 1932) comb. n.
priscillae sp. n.
rectilinea (Warren, 1906) comb. n.
remota (Warren, 1900) comb. n.
rosae sp. n.
roseilinearia (Dognin, 1892) comb. n.
sanguinipunctata (Dognin, 1906a) comb. n.
sellata (Warren, 1907) comb. n.
sigillaria Guenée, 1857 comb. rev.
degener (Prout, 1916)
sordifrons (Prout, 1932) comb. n.
tarachodes (Dyar, 1922) comb. n.
coruscula Ferguson, 1969 syn. n.
thelys (Prout, 1932) comb. n.
torsilinea (Warren, 1905a) comb. n.
toxeres (Prout, 1932)
venezuelae (Prout, 1932) comb. n., stat. n.
sectifimbria (Prout, 1932) syn. n.
avermiculata (Dognin, 1914) comb. n., stat. rev.
mustela monostigma Prout, 1916
vinocincta (Warren, 1901) comb. n.
viridicincta (Schaus, 1901) comb. n.
viridiscata (Dognin, 1923) comb. n.
winniae sp. n.
xaliria (Dognin, 1898) comb. n.
zernyi (Prout, 1932) comb. n.

NEMORIA SPECIES FROM NEARCTIC MEXICO EXCLUDED FROM THE PRESENT STUDY

(See Ferguson, 1985 for coverage of these)

arizonaria (Grote, 1883)
daedalea Ferguson, 1969
darwinia punctularia Barnes & McDunnough, 1918
leptalea Ferguson, 1969
mutaticolor Prout, 1912
obliqua obliqua (Hulst, 1898)
splendidaria (Grossbeck, 1910)
unitaria (Packard, 1873b)

NEOTROPICAL SPECIES TRANSFERRED FROM RACHEOSPILA TO SYNCHLORA

Synchlora amplimaculata (Herbulot, 1991) comb. n.
Synchlora atrapes atrapes (Druce, 1892) comb. n.
Synchlora atrapes trujilloi (Prout, 1932) comb. n.
Synchlora bidentifera (Warren, 1901) comb. n.
Synchlora concinnaria (Schaus, 1912) comb. n.
Synchlora decorata (Warren, 1901) comb. n.

- Synchlora dependens dependens* (Warren, 1904a) comb. n.
Synchlora dependens independens (Prout, 1916) comb. n.
Synchlora dependens megastigma (Warren, 1905a) comb. n.
Synchlora dependens tumefacta (Prout, 1910) comb. n.
Synchlora despicata (Prout, 1932) comb. n.
Synchlora ephippiaria (Möschler, 1886) comb. n.
Synchlora expulsata atrapoides (Prout, 1932) comb. n.
Synchlora isolata (Warren, 1900) comb. n.
Synchlora leucoceraria (Snellen, 1874) comb. n.
Synchlora magnaria (Bastelberger, 1911b) comb. n.
Synchlora merlinaria (Schaus, 1940) comb. n.
Synchlora pomposa (Dognin, 1898) comb. n.
Synchlora rufilineata rufilineata (Warren, 1897) comb. n.
Synchlora rufilineata albimargo (Prout, 1932) comb. n.
Synchlora superaddita (Prout, 1913a) comb. n.
Synchlora suppomposa (Prout, 1916) comb. n.
Synchlora tenuimargo tenuimargo (Warren, 1905b) comb. n.
Synchlora tenuimargo lineimargo (Prout, 1932) comb. n.
Synchlora venustula (Dognin, 1910) comb. n.

Key to the moths of *Nemoria*, *Lissochlora* and *Chavarriella* in Costa Rica

These keys are based on external rather than genital characters, to obviate the need for routine dissection. Most features are easy to observe but some differences are subtle. In a few cases, examination of genitalic features and comparison of these with the figures at the end of this paper will resolve doubtful identities.

Key to genera

Moths of the geometrine genera *Nemoria*, *Lissochlora*, and *Chavarriella* are usually pure green (occasionally slightly bluish) in ground colour, as in Plate 1, not yellowish-green, olive or ochre. They are distinguished from other, similarly coloured, geometrid moths that occur in Costa Rica (except those in *Synchlora* and *Phrudocentra*, referred to below) by the following external features.

In *Nemoria*, *Lissochlora* and *Chavarriella*, the abdomen usually has white or brown spots but lacks a row of several raised tufts. Their wings lack transparent areas, and the outer margin of the fore wing is straight or convex but the apex is not produced. The base of the hind wing lacks

the yellowish basal patch with a brown or olive band that is characteristic of *Rhodochlora*. The postmedial lines are often white but not thick, almost straight, and oblique, as in *Dichorda* Warren. [In *Dichorda* the postmedials of fore and hind wing together form a single straight oblique line on a conventionally set specimen.] Both pairs of hindtibial spurs are present in both sexes, and a frenulum is present, at least in the male. The front of the head is not white, or prominently swollen, and the palpi are not unusually small.

A few Neotropical ennomine genera, notably *Phyle* Herrich-Schäffer, have a similar ground colour to that of *Nemoria*, *Lissochlora*, and *Chavarriella*. However, in the Ennominae, the vein M2 of the hind wing is lacking or reduced to a fold. *Phyle* may be distinguished also by its wing pattern: the postmedial line ends in a small 'eye-spot' at the anal angle of the hind wing. In *Nemoria*, *Lissochlora*, and *Chavarriella*, the postmedial line ends at the inner margin of the hind wing and the 'eye-spot' is lacking.

Although they do not form part of this study, *Synchlora* and *Phrudocentra* are included in the key to genera since they may be mistaken for *Nemoria*, *Lissochlora* or *Chavarriella*.

- 1 Both pairs of wings with well-defined blotches at outer margins (one blotch at costal end and another at anal angle, as in Plate 1, top row) . *Chavarriella*
- Wings without blotches sited as in Plate 1, top row 2
- 2 Under-side of wings often with brown or blackish markings (usually obvious but occasionally faint) additional to any markings on upper surface. In Costa Rican species lacking such markings: fore wing tip produced and outer margin of wing slightly concave or sinuous *Phrudocentra*
- Under-side of wings without dark markings other than those corresponding to markings on upper surface. Fore wing tip not produced; outer margin of wing convex or straight 3
- 3 Wings with brown dots at veins, together with tiny white dots representing traces of postmedial and antemedial lines; without further brown blotches or speckles other than discal spot (Figs 7–9). Abdomen with white spots *Lissochlora* (*albociliaria*-group) [and certain other *Lissochlora* species not found in Costa Rica.]
- Wings patterned otherwise (plain; or with brown speckles but not combined with white dots; or with large blotches) or without white spots on abdomen 4
- 4 Outer margin of fore wing almost straight, that of hind wing slightly curved; wings without brown

blotches or speckles (other than discal spot). Antemedial and postmedial lines usually incomplete, represented by a series of white dots on the veins. Abdomen with plain white dorsal spots and usually with tiny dark spot at anterior end. (Plate 1, 2nd row, left; Figs 10–13.) . *Lissochlora* (*diarita*-group)

— Outer margins of wings usually curved as in Figs 14–67. Wings with or without brown markings; if without, then white antemedial and postmedial lines usually complete or absent rather than broken into dots and abdomen never with combination of dark and plain white spots 5

5 Male antennae weakly bipectinate (length of longest antennal branches not usually exceeding three times thickness of shaft at same point); antenna always tapering smoothly. Generally medium sized moths (wing length of Costa Rican species at least 12 mm) *Nemoria*

— Male antennae strongly bipectinate (length of longest antennal branches considerably more than three times thickness of shaft at same point); antenna tapering abruptly. Generally small moths (wing length less than 12 mm in many cases) . *Synchlora* [N.B. *S. despicata*, not in Costa Rica, does not have strongly bipectinate male antennae.]

Key to the species of *Chavarriella* in Costa Rica

1 Inner edge of costal blotch of hind wing straight or slightly curved; wing blotches whitish (at least in Costa Rica) (Plate 1, top row, right; Figs 2, 3) *fallax*

— Inner edge of costal blotch of hind wing distinctly curved or irregularly sinuous; wing blotches straw coloured or brown (Plate 1, top row, left; Figs 4–6) 2

2 Wing blotches straw coloured with dark brown edges; abdomen with large dorsal spots ((Plate 1, top row, left; Fig 70) *porcius*

— Wing blotches more uniformly brown; abdomen with small dorsal spots (Figs 4, 5) *semiornata*

Key to the species of *Lissochlora* in Costa Rica

1 Wings with brown dots on the veins, sited along the traces of the antemedial and postmedial lines (Figs 7–9). Front of head brown 2

— Wings without brown dots other than discal spots (Figs 10–13). Front of head green 3

2 Discal spots large and diffuse, extending to vein R in fore wing *manostigma*

— Discal spots small, not extending to vein R in fore wing *albociliaria* and *inconspicua* [see p. 57 for distinguishing genitalic characters]

3 Wavy white antemedial and postmedial lines on wings unbroken (Fig. 12). No dorsal dark spot at anterior end of abdomen *latuta*

— Antemedial and postmedial lines represented by a series of white dots on the veins, at most weakly joined (Plate 1, 2nd row left; Figs 10, 11, 13). Small dorsal dark spot at anterior end of abdomen 4

4 Dorsal dark spot at anterior end of abdomen not adjoining white spots (Fig. 71) *ronaldi*

— Dorsal dark spot adjoining white spot at anterior end of abdomen; spots usually tiny *freddyi* and *daniilo* [see p. 60 for distinguishing genitalic characters]

Key to the species of *Nemoria* in Costa Rica

1 Wings without brown speckles or blotches [apart from standard discal spots] (Plate 1, 3rd row) .. 20

— Fore or hind wing with some brown speckles or blotches (well-marked as in Plate 1, bottom row; or weakly marked as in Figs 26, 43) 2

2 Fore wing plain, hind wing with large brown blotch at inner margin (Figs 40, 41) 3

— Fore wing plain or patterned but plain fore wing never accompanied by large blotch at margin of hind wing 4

3 Wings with white antemedial and postmedial lines (Fig. 40) *astraea*

— Antemedial and postmedial lines represented by a series of brown dots on the veins (Fig. 41) *interlucens*

4 Wings with white antemedial and postmedial lines; without numerous scattered speckles or blotches (Figs 43, 44, 47, 55) 5

— Wings without distinct white antemedial and postmedial lines; with numerous scattered dark speckles or blotches (Figs 14–27, 42) 6

5 Hind wing with very large discal spot (Fig. 47) *pescadora*

— Brown spot on inner side of lines, at inner margin of fore wing (Figs 43, 44) *vermiculata*

6 Costa of fore wing with fine transverse striations (Plate 1, bottom row; Fig 17) 7

— Costa of fore wing without fine striations 11

7 Inner margin of hind wing with two well defined dark brown blotches or a single long blotch (Figs 17, 18) *eugeniae*

— Inner margin of hind wing without well defined dark brown blotches 8

8 Abdomen with a large white dorsal spot (Fig.

- 72) *adjunctaria*
- Abdomen with tiny white dorsal spots as in Fig. 73 9
- 9 Abdomen with dark brown dots towards posterior end (Fig. 73) *tickelli*
- Abdomen without dark brown dots towards posterior end 10
- 10 Postmedial markings of fore wing forming distinct brown blotch near costa, well away from where discal blotch extends towards costa (Fig. 21). Hind wing with veins M3 and Cu1 separate as in Fig. 69 *epaphras*
- Postmedial markings of fore wing forming distinct blotch near costa, close to where discal blotch extends towards costa (Fig. 20). Hind wing with veins M3 and Cu1 on short common stalk as in Fig. 68 *anae*
- 11 White interantennal fillet absent or diffuse and weakly contrasting with front of head 12
- White interantennal fillet strongly defined and contrasting with front of head 18
- 12 Wings with brown band near outer margin (Fig. 42) *ozalea*
- Wings without brown band near outer margin . 13
- 13 Wings extensively marked with strong brown squiggles (Fig. 16) *scriptaria*
- Wings with few or weak brown markings (Figs 24–26, 38, 39) 14
- 14 Outer margin of wings with row of brown or black dots (Figs 24–26) 15
- Outer margin of wings without row of dots 17
- 15 Front of head brown 16
- Front of head green *duniae*
- 16 Front of head dull brown. Discal spot of hind wing small, spot of fore wing slightly more conspicuous (Fig. 24) *saryae*
- Front of head reddish brown. Discal spots very large (blotched form) or fairly uniformly small (speckled form) (Figs 25, 26) *strigaria* (blotched form and speckled form)
- 17 Fore wing with dark blotch at apex (Fig. 39) . *erina*
- Fore wing without dark blotch at apex (Fig. 38) *punctilinea*
- 18 Fore wing with large central mottled brown area (Fig. 19) *hazalea*
- Fore wing without large central brown area 19
- 19 Fore wing with dark brown blotch at apex (Fig. 15) *elbae*
- Fore wing without dark brown blotch (Fig. 14) *aturia*
- 20 Abdomen and thorax with dorsal stripe (Figs 48, 80) *dorsilinea*
- Abdomen and thorax without stripe (abdomen usually with spots) 21
- 21 Dorsal spots of abdomen dark brown (Plate 1, 3rd row) or absent 22
- Dorsal spots of abdomen white or cream (plain, or ringed with reddish brown as in Plate 1, 2nd row, right) 32
- 22 Front of head brown, at least lower part or edges 23
- Front of head green, without brown markings . 28
- 23 Wings with fairly smooth white antemedial and postmedial lines 24
- Wings without white antemedial and postmedial lines 26
- 24 Postmedial line of hind wing almost straight (Fig. 43) *vermiculata* (♂)
- Postmedial line of hind wing bent at middle (Figs 33, 34) 25
- 25 Abdomen with anterior dorsal spot larger than median spot (Fig. 75) *rectilinea*
- Abdomen with anterior dorsal spot usually smaller than median spot or else both spots small (Fig. 74) *karlae*
- 26 Wings diffusely striated all over with white or colourless flecks (Fig. 27). Abdomen without dark spots *strigaria* (typical form)
- Wings not striated all over with whitish flecks; abdomen often with one or more dark brown dorsal spots 27
- 27 White interantennal fillet absent *punctilinea*
- White interantennal fillet present *aturia*
- 28 Postmedial line of hind wing distinctly smooth and almost straight (Fig. 46) *gerardinae*
- Postmedial line of hind wing waved, indistinct or bent at middle 29
- 29 White antemedial and postmedial lines of wings distinctly waved (Figs 35–37). Orange or reddish brown terminal line present 30
- White antemedial and postmedial lines of wings slightly waved or indistinct (Figs 28, 49). Terminal line absent or at most a trace on hind wing 31
- 30 Abdomen with anterior dorsal spot (on segment 1) extending onto segment 2; posterior spot (on segment 4) not extending onto segment 3 (Fig. 77) *carolinae*

- Abdomen with anterior dorsal spot not extending onto segment 2; posterior spot extending onto segment 3 (Fig. 76) *pacificaria* and *tutala*
[see p. 81 for distinguishing characters]
- 31 Wings with white antemedial and postmedial lines (Fig. 49). Hind wing with veins M3 and Cu1 on common stalk or occasionally meeting *remota*
 - Antemedial and postmedial lines very indistinct, marked by small diffuse patches of brown scales (Fig. 28). Hind wing with veins M3 and Cu1 separate *duniae*
- 32 Abdomen with plain white dorsal spots 33
 - Abdomen with some or all of dorsal spots ringed with reddish brown 34
- 33 Terminal line indistinct, olive or a trace of reddish brown. Discal spot of fore wing well developed (Fig. 65) *callirrhoe*
 - Terminal line distinct, reddish brown. Discal spots small (Figs 66, 67) *priscillae* and *adaluzae*
[see p. 84 for distinguishing genitalic characters]
- 34 Front of head brown, sometimes with green in upper part 35
 - Front of head green 45
- 35 Hind wing with veins M3 and Cu1 separate 36
 - Hind wing with veins M3 and Cu1 on common stalk which is occasionally extremely short 37
- 36 Wings with strongly pronounced unbroken terminal line; hind wing distinctly angulate (Fig. 52) *winniae*
 - Wings with terminal line normal or, if pronounced, broken into a dotted line; hind wing not distinctly angulate (Figs 50, 51) *vinocincta*
- 37 Wings without or with very weak reddish brown terminal line *nympharia*
 - Wings with the usual distinct reddish brown terminal line 38
- 38 Terminal line pronounced, giving margins a chequered appearance; discal spot of hind wing well developed (Fig. 45) *rosae*
 - Terminal line narrow (as normal in *Nemoria*); discal spots small 39
- 39 Brown discal spots absent or extremely faint; white postmedial lines of wings usually smooth (Figs 29, 30), or if slightly waved then sharply bent in hind wing (Fig. 32). Some or all dorsal spots of abdomen cream 40
 - Brown discal spots clearly present; white postmedial lines of wings at least slightly waved, not sharply bent, or indiscernible (Figs 53). All dorsal spots of abdomen white 41
- 40 Postmedial line of hind wing slightly bent (Fig. 30) *lorenae*
 - Postmedial line of hind wing distinctly bent (Fig. 29) *marielosae* and *cosmeta*
[see p. 78 for distinguishing genitalic characters]
- 41 Antemedial and postmedial lines of wings only just discernible (Fig. 53) *marianellae*
 - White antemedial and postmedial lines of wings distinct 42
- 42 Abdomen with more than three white dorsal spots (usually six or seven) *florae*
 - Abdomen with three white dorsal spots 43
- 43 Front of fore tibia with indistinct or incomplete white bar *isabelae*
 - Front of fore tibia with white bar complete and distinct 44
- 44 Front of head without green patches in upper part. Abdomen sometimes with tan patch joining posterior two dorsal spots (Fig. 81) *toxeres*
 - Front of head with green patches in upper part. Abdomen without tan patch joining posterior two dorsal spots *acutularia*
- 45 Middle spot of three main dorsal spots of abdomen not ringed with brown 46
 - Middle spot ringed with reddish brown, at least weakly 48
- 46 Front edge of interantennal fillet without tan band 47
 - Front edge of interantennal fillet with tan band *franciscae*
- 47 Wings with faint shadowy brown band on central side of antemedial and postmedial lines *dentilinea*
 - Wings without brown shading (in Costa Rican specimens) *defectiva*
- 48 Abdomen with three dorsal spots 49
 - Abdomen with more than three dorsal spots, at least traces *florae* and *agenoria*
[see p. 90 for distinguishing genitalic characters]
- 49 Hind edge of interantennal fillet with tan band *venezuelae*
 - Hind edge of interantennal fillet often with scattered tan scales but without complete band *gladyssae*

CHAVARRIELLA gen. n.

Type-species: *Comibaena lafayaria* Dognin, 1892, here designated.

ADULT (Plate 1, top row; Figs 1–6, 70). Mostly

of medium size for Geometrinae, fore wing length: 11–18 mm.

Ground colour a pure shade of green as in Plate 1, top row. Front of head brown with 2 white marks, often merged, in lower corners; 2 upper white or pale marks often very diffuse or indistinct, occasionally absent. White interantennal fillet with green band in front and usually with green area behind. Male antennae bipectinate but not strongly so, length of longest branches no more than about twice width of flagellum at same point; female antennae simple; antennae with white dorsal line along basal half of flagellum. Outer margins of wings curved as in Figs 1–6; apex of fore wing not produced; hind wing not angulate. Wing pattern: outer margins with a brown (or whitish edged with brown) blotch at costal end and another at anal angle; brown terminal line often broken between blotches, particularly on fore wing. Antemedial and postmedial lines of wings indistinct, waved, pale green bordered with darker green on inner side. Under-side of wings a paler version of upper side though costal blotch of fore wing sometimes pronounced. Venation: hind wing with M3 and CuA1 on short common stalk or just separate; Sc+R1 and Rs of hind wing touching but not fused. Front of fore tibia with whitish spot half way along outer edge; hind tibia with two pairs of spurs; hind tibia of male dilated, often strongly, and with apical extension. Dorsal ground colour of abdomen predominantly mottled brown (occasionally with green patches in *semiornata*; green band at sides of narrow blotched form of *fallax*); ventral surface whitish or cream. Abdomen spots white or cream; segment 2 with raised brown tuft flanked by small cream patches (cream patches sometimes small or diffuse). Sternite 3 of male abdomen with pair of fields of deciduous needle-like modified scales as in most Geometrinae.

GENITALIA ♂ (Figs 83, 141, 210). Genitalia simple. Uncus moderately long; slender, rod-like and often strongly spatulate with rounded or heart-shaped apex; socii semi-membranous, small and not normally erect. Gnathos a slender loop with a narrow sharp distal tooth. Valva much longer than broad, parallel-sided or slightly tapered, without basal costal process; usually without distal process but with very slight development of this in *pelops*. Transtilla bilobate; juxta a flat plate without papilla. Coremata absent or not noticeably developed. Saccus rounded or occasionally slightly notched. Aedeagus moderately slender to slightly swollen medially without any spines. Anellar plate extending

to middle or two-thirds length of aedeagus, ending in pair of short lobes. Sternite 8 produced posteriorly as two slight lobes shallowly notched between; anterior margin of sternite weakly concave; similar in dimensions to tergite or slightly shorter; midrib usually absent, occasionally present but weak. Tergite 8 with fairly straight posterior edge.

GENITALIA ♀ (Fig. 280). Genitalia simple: without pouch joining ostium and sternite 7 or sclerotized patches on sternite 7; ostial region unmodified; postostial plate indistinct. Apophyses anteriores more than half to two-thirds length of apophyses posteriores. Ductus bursae extremely short (much shorter than segment 7), without sclerotized antrum. Corpus bursae elongate and slender with bulbous anterior end, without signum.

DIAGNOSIS. The single slightly raised brown tuft on the second pale abdominal spot distinguishes *Chavarriella*. The wing pattern of marginal blotches also separates the genus from *Nemoria* and *Lissochlora* but not from the superficially similar genus *Oospila*. However, *Oospila*, unlike *Chavarriella*, has several pronounced tufts on the abdomen.

The genitalia of *Chavarriella* are simple, apparently lacking in derived characters, and more or less uniform throughout the genus. The 14 species (3 in Costa Rica) here recognised are defined on the basis of the only evidence currently available, namely, the external morphology, particularly differences in wing pattern. Their status as distinct species remains to be confirmed. Synonymies were made in cases where no clear morphological distinctions could be found.

REMARKS. This genus is named for María Marta Chavarría Díaz, the field co-ordinator of the INBio parataxonomists, in honour of her years of extraordinarily diligent facilitation of the field inventory and her essential help with the lives of the parataxonomists.

The blotches of the wings vary in size within each of the three species of *Chavarriella* occurring in Costa Rica. This is most evident in the costal blotch of the hind wing.

BIOLOGICAL NOTES. Host-plants unknown.

DISTRIBUTION. *Chavarriella* is widespread in Central and southern America from Nicaragua to Brazil and Bolivia.

***Chavarriella fallax* (Warren) comb. n.**

(Plate 1; Figs 1–3, 280)

Racheospila fallax Warren, 1907: 208. Holotype ♂, PERU (BMNH) [examined].*Racheospila distinguenda* Dognin, 1923: 18. Holotype ♂, COLOMBIA (USNM) [examined]. **Syn. n.***Racheospila fallax allotaxis* Prout, 1932: 37. Holotype ♂, COLOMBIA (BMNH) [examined]. **Syn. n.***Racheospila fallax cohibita* Prout, 1932: 37. Holotype ♂, COLOMBIA (BMNH) [examined]. **Syn. n.**

ADULT (Plate 1; Figs 1–3). Front of head mid to very dark brown. Interantennal fillet broad; narrow area behind fillet green or (in narrow blotched form) bright reddish brown. Wing pattern: blotches whitish (in Costa Rica) or cream to brown (elsewhere), with dark brown edges; inner edge of costal blotch of hind wing straight or slightly curved. Blotches divided into segments by brown lines: anal blotch, particularly of fore wing, consisting of one main segment (typical form) or two (narrow blotched form); costal blotch of hind wing consisting of three segments (typical form) or two, occasionally three (narrow blotched form). Antemedial and postmedial lines only just visible. Hind wing with veins M3 and CuA1 on short common stalk, meeting or occasionally just separate. Front of fore tibia: lower half dark brown or (in Costa Rica) golden brown shading to dark brown towards inner edge, upper half golden brown. Abdomen with 3 distinct white dorsal spots plus further traces; 'second' spot fairly large; dorsal ground colour generally paler than in *porcius* or *semiornata* but strong reddish brown in narrow blotch form.

GENITALIA ♂. As described in generic description (p. 52).**GENITALIA** ♀ (Fig. 280). As described in generic description (p. 52).**DIAGNOSIS.** *C. fallax* is distinguished by the shape of the costal blotch on the hind wing and (at least in Costa Rica) by the pale colour of the blotches.**VARIATION.** In addition to the fairly widespread typical form of *fallax* there is another form (provisionally regarded as conspecific and here known as the narrow blotched form) which is apparently limited to Costa Rica and differs in having a narrow costal blotch of the fore wing and in other characters as described above. The blotches of the wings of *fallax* are usually whitish

or pale, but the costal blotch of the fore wing, in particular, is brownish in some Colombian and Peruvian specimens of the typical form.

BIOLOGICAL NOTES. Moths have been found at altitudes of 600–1114 m in Costa Rica (narrow blotched form: 500–700 m); 400 – c. 2150 m in Colombia and Peru; in January to March, May, July, August and November (narrow blotched form: January to March, June to August and October) (in Costa Rica).**DISTRIBUTION.** Typical form: from Costa Rica to Venezuela and Bolivia. Narrow blotched form: known only from northern and central Costa Rica.**MATERIAL EXAMINED** (74 specimens; including 4 ♂, 1 ♀ genitalia preparations)

Holotype ♂ (*fallax*), **SE. Peru:** Río Inambari, La Oroya, c. 950 m ('3100 ft'), x.1904 (*Ockenden*) (BMNH). Holotype ♂ (*distinguenda*), **Colombia:** Cañón del Tolima, 1700 m, x.1909 (*Fassl*) (Type No. 32603; USNM). Holotype ♂ (*allotaxis*), **Colombia:** Muzo, 400–800 m (*Fassl*) (BMNH). Holotype ♂ (*cohibita*), **Colombia:** E. Colombia, upper ('Ob.') Río Negro, 800 m (*Fassl*) (BMNH).

Costa Rica: *Alajuela Province:* 5 km N. of Col. Palmarena, San Ramón Forest Reserve, Río San Lorencito, 800 m; 7 km NW. of Dos Ríos, El Ensayo, Finca La Campana, 700 m; 2 km SW. of Dos Ríos, Finca San Gabriel, 600 m (UTM 318800,383500), 630 m, 650 m; 8–9 km S. of Santa Cecilia, Estacion Pitilla, 680–700 m; *Cartago Province:* Moravia de Chirripo, 1114 m. *Guanacaste Province:* Rincon National Park, 4 km E. of Casetilla, 750 m; *San José Province:* Braulio Carrillo National Park, Estacion Carrillo, 700 m; (INBio and BMNH). **Venezuela:** Aragua, Rancho Grande (CMNH). **Colombia:** Cañón del Tolima, 1700 m; slopes of Chocó, Siató, Río Siató; (including 1 ♂, *allotaxis* paratype) Muzo, 400–800 m (*Fassl*); upper ('Ob.') Río Negro, 800 m; San Antonio, c. 1800 m; (BMNH). **Peru:** Carabaya, Río Inambari, La Oroya, c. 900 m, 950 m; Carabaya, Oconeque, c. 2150 m; Carabaya, Tinguri, c. 1050 m; Santo Domingo, c. 1850 m; (BMNH). **Bolivia:** Cochabamba (BMNH).

Narrow blotched form (15 specimens; including 1 ♂ genitalia preparation)

Costa Rica: *Alajuela Province:* 16 km ENE. of Quebrada Grande, Finca San Gabriel, 650 m; 9 km S. of Santa Cecilia, Estacion Pitilla, 700 m, W85° 25'40", N10° 59'26"; *Guanacaste Province:* Rincon National Park, 4 km E. of Casetilla; 7 km S. of Santa Cecilia, Estacion Pitilla, Casa Rob-

erto, 500 m, W85° 25'33"Q, N11° 00'18"; *San José Province*: Braulio Carrillo National Park, Estacion Carrillo, 700 m; (INBio and BMNH).

***Chavarriella porcius* (Schaus) comb. n.**

(Plate 1; Figs 6, 70)

Racheospila porcius Schaus, 1912: 291. LECTOTYPE ♂, COSTA RICA (USNM), here designated [examined].

ADULT (Plate 1; Fig. 6). Front of head dark brown sometimes with a few straw flecks. Wing pattern: blotches straw-coloured with dark brown edges; inner edge of costal blotch of hind wing distinctly curved. Hind wing with veins M3 and CuA1 on short common stalk or occasionally meeting. Front of fore tibia: lower half or two-thirds dark brown, upper part golden brown; spot at outer edge straw, sometimes diffuse. Abdomen with 2 distinct white dorsal spots, posterior spot large (Fig. 70).

GENITALIA ♂. As described in generic description (p. 52).

GENITALIA ♀. As described in generic description (p. 52).

DIAGNOSIS. *C. porcius* is distinguished by the shape and colour of its wing blotches. The white spots on the abdomen are larger than those of *semiornata* and more distinct than those of *fallax*.

BIOLOGICAL NOTES. Moths have been found at altitudes of 700–1800 m in February to October and December (in Costa Rica).

DISTRIBUTION. Costa Rica and Panama.

MATERIAL EXAMINED (68 specimens; including 3 ♂, 1 ♀ genitalia preparations) Lectotype ♂, Costa Rica: [Cartago Province,] Juan Viñas, ii (genitalia slide no. 57,602; Type No. 17731; USNM).

Costa Rica: *Alajuela Province*: 9 km S. of Santa Cecilia, Estacion Pitilla, 700 m, UTM 330200,380200; Volcán Poás, 8 km N. of Vara Blanca, 1500 m; *Cartago Province*: 16 km S. of San Isidro de Tejar, 3 km S. of Casa Mata, 1800 m; Juan Viñas, c. 750 m; Orosi, 1200 m; Río Grande de Orosi, Tapanti, 1300–1400 m; *Guana-caste Province*: Rincon National Park, 4 km E. of Casetilla, 750 m; Volcán Cacao, SW. side, Estacion Cacao ('Mengo'), 1100 m, W85° 28'10", N10° 55'43; Volcán Cacao, W. side, Estacion Cacao ('Mengo'), Derrumbe, 1400 m; *Puntarenas Province*: Monteverde, 1300 m, 1430 m (INBIO/BMNH; UCB); 2 km E. of Monteverde, 1500 m, 1530 m (INBIO/BMNH; UCB); 11 km

NW. of Monteverde, Las Nubes; *San José Province*: Braulio Carrillo National Park, Estacion Carrillo, 700 m; Braulio Carrillo National Park, Estacion Zurquí (el Tunel), 1500 m, 10° 04'N, 84° 01'W; 'La Palma', c. 1550 m (CMNH); (INBio and BMNH). Panama: Chiriquí (BMNH).

***Chavarriella semiornata* (Warren) comb. n.**

(Figs 4, 5, 83, 141, 210)

Racheospila semiornata Warren, 1901: 450. LECTOTYPE ♂, PANAMA (BMNH), here designated [examined].

Racheospila spasma Dognin, 1923: 17. LECTOTYPE ♂, COLOMBIA: (USNM), here designated [examined]. Syn. n.

Racheospila diminuta Dognin, 1923: 18. Holotype ♂, COLOMBIA (USNM) [examined]. Syn. n.

Racheospila semiornata abornata Prout, 1932: 36. Holotype ♂, COLOMBIA (BMNH) [examined]. Syn. n.

Racheospila spasma oroyana Prout, 1932: 36. Holotype ♂, PERU: (BMNH) [examined]. Syn. n.

ADULT (Figs 4, 5). Front of head dark brown or tan. Wing pattern: blotches tan edged with darker brown or uniformly brown; inner edge of costal blotch of hind wing distinctly curved. Hind wing with veins M3 and CuA1 on common stalk, occasionally almost meeting. Front of fore tibia golden brown, shading to deep tan in lower half, deepest towards inner edge; white spot at outer edge often indistinct. Abdomen with 2 white dorsal spots; all markings smaller than in *fallax* and *porcius*.

GENITALIA ♂ (Figs 83, 141, 210). As described in generic description (p. 52).

GENITALIA ♀. As described in generic description (p. 52).

DIAGNOSIS. *C. semiornata* is distinguished from *fallax* and *porcius* by its fairly uniformly brown wing blotches and small spots on the abdomen.

VARIATION. The blotches of the wings vary from tan to dark brown.

BIOLOGICAL NOTES. Moths have been found at altitudes of 0–1460 m in Costa Rica (to 2000 m in Colombia), in January to September, November and December (in Costa Rica).

DISTRIBUTION. From Nicaragua to Peru.

MATERIAL EXAMINED (78 specimens; including 5 ♂, 1 ♀ genitalia preparations)

Lectotype ♂ (*semiornata*) **Panama:** Chiriquí (genitalia slide Geom. 12881; BMNH). Lectotype ♂ (*spasma*) **Colombia:** [Valle,] San Antonio, 2000 m, 26.viii.1908 (*Fassl*) (Type No. 32604; USNM). Holotype ♂ (*diminuta*), **Colombia:** [Cauca,] Popayan, 1896 (*Gaujon*) (Type No. 32605; USNM). Holotype ♂ (*abornata*), **E. Colombia:** upper ('Ob.') Río Negro, 800 m (*Fassl*) (genitalia slide Geom. 14062; BMNH). Holotype ♂ (*oroyana*), **SE. Peru:** Carabaya, R. Inambari, La Oroya, c. 950 m ('3100 ft'), ix.1905 (*Ockenden*) (genitalia slide Geom. 16558; BMNH).

Nicaragua: Edén (CMNH). **Costa Rica:** *Alajuela Province:* 5 km NW. of Dos Ríos, Finca Campana, 750 m; 16 km ENE. of Quebrada Grande, Finca San Gabriel, 630 m, 650 m; 9 km S. of Santa Cecilia, Estacion Pitilla, 700 m, W85° 25'40", N10° 59'26"; E. slope of Volcán Cacao, Cerro Campana ['Compañía'], 650 m (UCB); NE. slope of Volcán Poás, 8 km N. of Vara Blanca, 1400 m (UCB); [*Cartago Province:*] Juan Viñas; Orosi, 1200 m; *Guanacaste Province:* Rincon National Park, 4 km E. of Casetilla; Volcán Cacao, W. side, Estacion Cacao, Derrumbe, 1400 m; *Heredia Province:* Puerto Viejo de Sarapiquí, Finca La Selva (OTS), 50 m; *Puntarenas Province:* Monteverde, 1400 m; Monteverde, Cloud Forest Reserve HQ, 1450 m (UCB); 2 km E. of Monteverde, 1460 m (UCB); 11 km NW. of Monteverde, Las Nubes; Osa Peninsula, Corcovado National Park, Sirena, 0–100 m, UTM 270500,508300; San Vito, Las Cruces Biol. Station, 1200 m; *San José Province:* Braulio Carrillo National Park, Estacion Carrillo, 700 m; (INBio and BMNH unless stated otherwise). **Panama:** 1 ♂, (*semiornata* paralectotype), Chiriquí (BMNH). **Colombia:** (including 1 ♂, *abornata* paratype) upper ('Ob.') Río Negro, 800 m (*Fassl*); San Antonio, c. 1800 m; (BMNH). **Ecuador:** Bolivar, Balzapamba; Bolivar ('Los Rios'), La Chima; (BMNH). **Peru:** Carabaya, R. Inambari, La Oroya, c. 950 m; Carabaya, Tinguri, c. 1050 m; [Cuzco,] Marcapata; (BMNH).

LISSOCHLORA Warren, 1900

Lissochlora Warren, 1900: 134. Type species: *Aplodes flavifimbria* Warren, 1897, by original designation. [Cited as a synonym of *Racheospila* by Prout, 1912: 102.] **Gen. rev.**

ADULT (Plate 1, 2nd row, left; Figs 7–13; 71). Small or of medium size for Geometrinae, fore

wing length: 8–19 mm (9–16 mm in Costa Rican species).

Ground colour a pure shade of green as in Plate 1, 2nd row, left. Front of head usually with 2 white marks, sometimes merged, in lower corners; white interantennal fillet; hind edge of head green. Male antennae bipectinate, length of longest branches ranging from nearly twice to more than seven times width of flagellum at same point; female antennae simple; antennae with white dorsal line along basal half of flagellum. Outer margins of wings curved as in Figs 7–9 (*albociliaria*-group and various other species) or weakly curved, fore wing almost straight and with sharp apex as in Figs 10–13 (*diarita*-group) but not produced; hind wing not strongly angulate. Wing pattern: plain or with brown speckles, usually confined to postmedial and antemedial lines (in addition to discal spots) but other speckles present in a few species outside Costa Rica. Wings usually with reddish brown terminal line, sometimes weak. Under-side of wings a paler version of upper side. Venation: Sc+R1 and Rs of hind wing touching but not fused. Hind tibia with two pairs of spurs; hind tibia of male dilated, often strongly, and with apical extension. Dorsal ground colour of abdomen predominantly green; ventral surface whitish or cream; 3 or more white dorsal spots, plain or ringed with reddish brown; sometimes with black or dark brown dorsal spot at anterior end. Sternite 3 of male abdomen with pair of fields of deciduous needle-like modified scales as in most Geometrinae.

GENITALIA ♂ (Figs 84–90, 142–149, 211–217). Uncus very short (as in Fig. 145) to moderately short (as in Fig. 147), broad to very slender. Socii extending nearly as far as uncus to slightly beyond uncus; variously shaped. Gnathos either a slender loop with a narrow sharp distal tooth as in *Nemoria* or a broader loop with distal tooth often broad and blunt. Valva longer than broad, variously shaped though often with strongly broadened costal side; costal side sclerotized, without basal costal process (or at most with weak development of this), usually with distal process. Transtilla bilobate; juxta funnel-shaped with tiny to large closed papilla, a cone, or flat plate without papilla. Coremata usually present, well-developed as a dense brush in most species, though sac short or of moderate length rather than the very long sac seen in many Neotropical *Nemoria* species. Saccus rounded or truncate, sometimes with slight notch; sacculus of valva commonly projecting slightly beyond saccus. Aedeagus often sinuous; with slight thorn-like

projection, bulge or kink, normally in apical half. Anellar plate small to large; usually extending to middle or two-thirds length of aedeagus but occasionally to beyond apex of aedeagus. Sternite 8 usually very weakly produced posteriorly as two lobes, with broad shallow notch or slight excision; anterior margin of sternite moderately concave; much broader than long, often much shorter than tergite; midrib usually weak or absent, rarely strongly defined. Tergite 8 rounded or with shallow posterior excision.

GENITALIA ♀ (Figs 268–271, 281–289, 330–332). Apophyses anteriores (measured to margin of eighth segment) less than one-quarter to slightly more than half length of apophyses posteriores. With or without somewhat sclerotized pouch joining ostium and sternite 7; postostial plate not distinct from other ostial structures. Ductus bursae much shorter than segment 7 or (*albociliaria*-group) as long as or longer than segment 7; with short sclerotized antrum in form of a collar split dorsally. Corpus bursae very slender and elongate or (*albociliaria*-group) with large bulbous anterior part; with ductus bursae adjoining subterminally, ductus seminalis more terminal. Anterior end of corpus bursae with or without signum. Signum, if present, in form of pouch with two projecting corners.

DIAGNOSIS. *Lissochlora* lacks the distinctive wing pattern and abdominal tuft of *Chavarriella*. Many species are small and plain but the *albociliaria*-group and other similar species of *Lissochlora* can be recognised by their wing pattern of brown speckles together with white dots, confined to the postmedial and antemedial lines. The few similarly patterned *Nemoria* species lack the white abdominal spots of *Lissochlora*. However, one unidentified geometrine species (genus unknown) can be distinguished from the *albociliaria*-group of *Lissochlora* only by genitalic characters, including a strongly bifid uncus. The *diarita*-group of *Lissochlora* have straighter wing margins than in *Nemoria* or other externally similar genera. Outside Costa Rica certain other species of *Lissochlora* could be mistaken for *Nemoria* or *Synchlora* but are distinguished by genitalic characters. *Lissochlora* sometimes has a slight basal costal process of the male valva but this is not well developed as it is in *Nemoria*, and *Lissochlora* lacks the reduced uncus and modified socii of *Synchlora*. The slight projection or kink of the aedeagus is a characteristic feature of the genus and its occasional absence is presumed to be a secondary loss. The female genitalia of *Lissochlora* differ from those

of the externally similar genera discussed above in the form of the antrum and the signum, when present, is characteristic.

BIOLOGICAL NOTES. Host-plants unknown.

DISTRIBUTION. Widespread in Central and southern America from Neotropical Mexico to Paraguay.

The *albociliaria*-group

ADULT. Front of head brown; broad interantennal fillet with reddish brown band immediately behind. Male antennae strongly bipectinate: length of longest branches nearly four times to more than seven times width of flagellum at same point. Outer margins of wings distinctly curved (Figs 7–9). Wings with brown dots at veins, accompanied by tiny white dots representing traces of postmedial and antemedial lines; without further brown blotches or speckles other than discal spot. Venation: hind wing with M3 and CuA1 on common stalk or separate. Front of fore tibia pale to dark brown with oblique white bar. Abdomen with 3 white dorsal spots ringed with at least a trace of reddish brown.

GENITALIA ♂ (Figs 84–86, 142–145, 211–213). Uncus hood-like, broad, tapering to small crest of tiny teeth and wispy tuft of 'hairs'; process of uncus (part posterior to base of socii) short (see Figs 142, 144, 145). Socii with narrow apical part and broad base. Gnathos a fairly broad loop with broad blunt distal tooth. Juxta usually without papilla. Sternite 8 often distinctly shorter than tergite and much broader than long (always so in Costa Rican species). Tergite 8 rounded posteriorly. Aedeagus straight.

GENITALIA ♀ (Figs 268, 269, 281–285, 330–332). Apophyses anteriores slightly less to slightly more than half length of apophyses posteriores. Corpus bursae with bulbous anterior part usually large; signum in form of pouch with two projecting corners, often sharply produced, with well defined curved line or ridge at opening.

REMARKS. The distal tooth of the gnathos is least broadened and blunt in the male genitalia of *purpureotincta* and exceptionally broad in *paegnina* (neither species found in Costa Rica). *L. paegnina* is atypical in certain other aspects: the uncus is unusually long and with a bifurcated tip instead of the usual crest of tiny teeth, and the juxta has a tiny papilla. In females the corpus bursae varies from weakly tapered (Fig. 269) to strongly tapered in the anterior part (Fig. 268).

I have examined two females of an unidenti-

fied species from Costa Rica and Panama (for genitalia see Figs 285, 332) which may belong in the *albociliaria*-group but I refrain from describing a new species since they lack external distinguishing features and have not been associated with a male. The signum of one specimen lacks the projecting corners characteristic of the *albociliaria*-group and of certain other species but these corners are present in the other specimen, though not so sharply produced as usual.

DISTRIBUTION. As in genus description.

The *albociliaria*-group comprises seven described species, three of which occur in Costa Rica. (See catalogue of extralimital species for the others.)

***Lissochlora albociliaria* (Herrich-Schäffer)
comb. n.**

(Figs 7, 84, 142, 211, 268, 269, 281, 282, 330)

Geometra albociliaria Herrich-Schäffer, 1855: pl. 61, fig. 344. **LECTOTYPE**, VENEZUELA (MNHU), here designated [examined].

Racheospila albociliaria (Herrich-Schäffer); Guenée, 1857: 373.

Racheospila dubiaria Oberthür, 1916: 90; fig. 3241. **Holotype**, VENEZUELA (BMNH) [examined]. **Syn. n.**

ADULT (Fig. 7). Front of head tan to reddish brown. Wings with small discal spots, not extending to vein R in fore wing. Hind wing with veins M3 and CuA1 separate. Front of fore tibia pale to mid brown, darker towards inner edge, usually with whitish upper tip. Dorsal spots of abdomen: posterior spot sometimes only a trace and sometimes connected to middle spot by tan area.

GENITALIA ♂ (Figs 84, 142, 211). Valva shorter than tegumen plus uncus, blunt and parallel-sided; distal process of costa a faintly serrated lobe, usually rounded, with edge continued as a short ridge on inner surface of valva. Anellar plate truncate, extending almost to apex of aedeagus.

GENITALIA ♀ (Figs 268, 269, 281, 282, 330). Without pouch joining ostium and sternite 7; ostial region with wrinkled sclerotized pouch, usually with slight medial notch.

DIAGNOSIS. *L. albociliaria* has smaller discal spots on the wings than does *manostigma*, and tends to have larger abdominal spots than in *inconspicua*. Genitalic differences are stronger; males are distinguished by the form of the distal process of the valva and females by the form of the ostial region.

REMARKS. Herrich-Schäffer described *R. albociliaria* from an unspecified number of specimens. One specimen examined is considered likely to belong to his type-series and is here designated as the lectotype. This specimen is in the collections of the MNHU, Berlin, the depository of Herrich-Schäffer's collection, and is labelled '*Racheospila albociliaria* H.Sch. Venezuela'. The specimen is set in much the same way as the specimen figured in the original description.

VARIATION. The projecting corners of the female signum vary from moderately produced as in Fig. 330 to strongly produced, similar to those of *inconspicua* (Fig. 331). Apart from the typical form described above, two other forms are treated here as conspecific with *albociliaria*. In one form, known only from northwestern Costa Rica, the male genitalia (Fig. 143) have a longer valva, which is about the same length as the tegumen plus uncus, similar to that of *inconspicua* but tapered only near tip. In the single female examined of this form the ostial structure is only slightly wrinkled. In the other form, from Colombia, the only male studied has an oblique tip to the valva, the uncus lacks a crest and tuft, and the anellar plate is short and rounded.

BIOLOGICAL NOTES. Moths have been found at altitudes of 1200–1500 m, in January, April, and June to November (in Costa Rica).

DISTRIBUTION. Typical form: central and southern Costa Rica, Panama and Venezuela.

MATERIAL EXAMINED (25 specimens, including 2 ♂, 6 ♀ genitalia preparations)

Lectotype ♀ (*albociliaria*), **Venezuela** (*Maassen*) (genitalia slide no. LMP 243; MNHU). Holotype ♀ (*dubiaria*), **Venezuela** (genitalia slide Geom. 15452; BMNH).

Costa Rica: [*Cartago Province*:] Orosi, 1200 m; Río Grande de Orosi, Tapanti, 1300–1400 m, 9° 46'x 83° 50'; *Heredia Province*: 8.2 km downhill Vara Blanca, El Angel waterfall, 1350 m; *Puntarenas Province*: Monteverde, c. 1350 m (CVCJ), 1400 m; 11 km NW. of Monteverde, Las Nubes; *San José Province*: Braulio Carrillo National Park, Estacion Zurquí (el Tunel), 1500 m, 10° 04'N, 84° 01'; (INBio and BMNH unless stated otherwise). **Panama:** Chiriquí (MNHU); Volcán de Chiriquí, c. 900–1250 m (BMNH).

Form or species near *albociliaria*: (2 ♂, 1 ♀, including 1 ♂, 1 ♀ genitalia preparations)

Costa Rica: *Guanacaste Province*: Volcán Cacao, W. side, Estacion Cacao ('Mengo'), Derumbe, 1400 m (INBio and BMNH).

Lissochlora inconspicua (Bastelberger)
comb. n.

(Figs 9, 85, 144, 212, 283, 331)

Racheospila inconspicua Bastelberger, 1911a: 54.
Holotype ♂, COLOMBIA: 'Cauca', Jimenez,
500 m ('1600 ft'), iii (Bastelberger Coll.)
(SMF) [transparency examined].

ADULT (Fig. 9). Front of head reddish or mid brown; reddish brown band behind interantennal fillet narrow or broken. Wings with small discal spots, not extending to vein R in fore wing; with or without reddish brown terminal line. Hind wing with veins M3 and CuA1 separate. Abdomen with 3 white dorsal spots, ringed with reddish brown though sometimes only a trace; posterior or all spots small; anterior spot with dull or dark mark at anterior edge.

GENITALIA ♂ (Figs 85, 144, 212). Valva slightly longer than tegumen plus uncus, tapering in distal half; distal process of costa a weakly serrated lobe, usually rounded, with edge continued as a long ridge on inner surface of valva. Anellar plate broad and truncate, extending to apex of aedeagus or beyond.

GENITALIA ♀ (Fig. 283, 331). Without pouch joining ostium and sternite 7; ostial region with smooth semicircular sclerotized plate.

DIAGNOSIS. *L. inconspicua* is likely to be confused with *albociliaria* and *manostigma* and differences are discussed under these species. The smooth ostial plate of the female genitalia is characteristic.

REMARKS. Specimens here identified as *inconspicua* were compared with a photographic transparency of the holotype and are indistinguishable from that specimen. However, the poor condition and lack of the abdomen of the holotype precludes absolute verification of its identity.

BIOLOGICAL NOTES. Moths have been found at altitudes of 700 – c. 750 m in Costa Rica (to 800 m in Colombia), in January, June, July and October (in Costa Rica).

DISTRIBUTION. Known from few localities in central Costa Rica and in Colombia.

MATERIAL EXAMINED (7 specimens; including 4 ♂, 2 ♀ genitalia preparations)

Costa Rica: [Cartago Province:] Juan Viñas (USNM); Tuis, c. 750 m (USNM); **San José Province:** Braulio Carrillo National Park, Estación Carrillo, 700 m (INBio; BMNH). **Colombia:** upper ('Ob.') Río Negro, 800 m (BMNH).

Lissochlora manostigma (Dyar) **comb. n.**

(Figs 8, 86, 145, 213, 284)

Racheospila manostigma Dyar, 1912: 91. Holotype ♀, MEXICO (USNM) [examined].

ADULT (Fig. 8). Front of head mid to dark brown. Front edge of interantennal fillet with 2 small reddish brown marks which are sometimes indistinct or joined to form narrow diffuse border; reddish brown band behind fillet narrow. Wings with large diffuse discal spots, extending to vein R in fore wing. Hind wing with veins M3 and CuA1 usually separate, occasionally just meeting. Abdomen with 3 white dorsal spots; anterior spot ringed with reddish brown, middle spot usually less distinctly or not ringed, small posterior spot (and rarely a fourth trace) surrounded by dull brown area.

GENITALIA ♂ (Figs 86, 145, 213). Distal tooth of gnathos fairly slightly broadened. Valva (plus process) usually of similar length to tegumen plus uncus (valva slightly shorter measured without process), blunt and parallel-sided; distal process of costa a large spine with one or usually more smaller spines in hairy tuft. Anellar plate truncate to rounded, not extending to apex of aedeagus.

GENITALIA ♀ (Fig. 284). With shallow pouch forming strong U- or V-shape, flanked by pair of broad pouches, joining ostium and sternite 7; ostial region with moderately small, partly rugose and wrinkled, sclerotized structure.

DIAGNOSIS. *L. manostigma* has larger discal spots than *albociliaria* or *inconspicua* and its genitalia are distinctive in the form of the costal process of the male valva and the pouches joining the female ostium and sternite 7. It is closest to *purpureotincta* (not found in Costa Rica) but the male genitalia of that species have an obliquely produced tip to the valva and a slightly different distal costal process; female genitalia of *purpureotincta* have a huge sclerotized structure in the ostial region.

VARIATION. In the single male examined from Mexico the valva plus distal costal process is shorter than the tegumen plus uncus.

BIOLOGICAL NOTES. Moths have been found at altitudes of 0–700 m in Costa Rica (to 1190 m in Mexico), in January, March, May to September, November and December (in Costa Rica).

DISTRIBUTION. From Neotropical Mexico to Costa Rica.

MATERIAL EXAMINED (36 specimens; including 7 ♂, 4 ♀ genitalia preparations)

Holotype ♀, **Mexico**: [Veracruz,] Misantla, v. 1910 (Müller) (the genitalia slide no. 57,568; Type No. 14289; USNM).

Mexico: Guerrero, 15 km NW. El Paraíso, 1190 m (CMNH). **Guatemala**: Cayuga (CMNH; USNM). **Nicaragua**: junction of rivers Waspuk and Wanks, c. 90 m (BMNH). **Costa Rica**: *Alajuela Province*: 7 km NW. of Dos Ríos, El Ensayo, Finca La Campana, 700 m; 2 km SW. of Dos Ríos, Finca San Gabriel, 600 m (UTM 318800,383500), 650 m; 9 km S. of Santa Cecilia, Estacion Pitilla, 700 m; [*Cartago Province*:] Juan Viñas (USNM); Sitio (CMNH); *Heredia Province*: Puerto Viejo de Sarapiquí, Finca La Selva, 40 m; [*Limón Province*:] Guapiles (BMNH; CMNH; USNM); Sixaola River (BMNH; CMNH; USNM); N. edge Tortuguero National Park, Cerro Tortuguero, 0–100 m; *Puntarenas Province*: Osa Peninsula, Corcovado National Park, Sirena; *San José Province*: Braulio Carrillo National Park, Estacion Carrillo, 600 m (UCB), 700 m; (INBio and BMNH unless stated otherwise).

The *diarita*-group

ADULT. Front of head green; narrow orange-tan band or at least a few scattered scales at hind edge of interantennal fillet. Male antennae bipectinate, sometimes moderately strongly; length of longest branches less than twice to four times width of flagellum at same point. Outer margins of wings weakly curved, fore wing almost straight and with sharp apex as in (Figs 10–13). Wing pattern plain apart from white antemedial and postmedial lines or dots. Abdomen with up to 7 tiny plain white dorsal spots, often also with small black or dark brown dorsal spot at anterior end.

GENITALIA ♂ (Figs 87–90, 146–149, 214–217). Gnathos a slender loop, or occasionally slightly broadened, with a narrow sharp distal tooth. Projection, kink or bulge of aedeagus often more weakly developed than that in the *albociliaria*-group. Anellar plate not extending to apex of aedeagus.

GENITALIA ♀ (Figs 270, 271, 286–289). Apophyses anteriores less than one-quarter to half length of apophyses posteriores. Ductus bursae much shorter than segment 7. Corpus bursae very slender and elongate with small bulbous anterior end; without signum.

DISTRIBUTION. As in genus description. The

diarita-group comprises 15 species, four of which occur in Costa Rica (see catalogue of extralimital species for the others).

Lissochlora daniloi sp. n.

(Figs 10, 87, 146, 214, 286)

ADULT (Fig. 10). Fore wing length: ♂, 9–12 mm; ♀, 10–12 mm.

Wings with white antemedial and postmedial lines reduced to series of dots on the veins. Hind wing with veins M3 and CuA1 on short common stalk, rarely meeting. Front of fore tibia brownish green or occasionally pale brown, without oblique white bar. Abdomen with up to 7 white spots; anterior spot (on terga 1) with dark patch on anterior side.

GENITALIA ♂ (Figs 87, 146, 214). Uncus short and broad with rounded bulbous or blunt apex; socii very slender. Costal side of valva not strongly broadened and not increasing distally; ending before tip of valva in slight distal process with dense patch of spinules aligned lengthwise with the valva and often including one larger spine. Transtilla lobes usually large; juxta with large or small papilla. Aedeagus slightly curved or straight; anellar plate narrow, tapered or spatulate.

GENITALIA ♀ (Fig. 286). Apophyses anteriores short, about one-quarter (or less) length of apophyses posteriores. With sinuous crescent-shaped wrinkled pouch joining ostium and sternite 7. Corpus bursae extremely slender.

DIAGNOSIS. *L. daniloi* and *freddyi* cannot be separated reliably on external features although males of the latter are larger. The form of the spinulose distal process together with the broad uncus in the male genitalia distinguishes *daniloi* from *freddyi* and all other species. The form of the pouch joining the ostium and sternite 7 distinguishes males of *daniloi* from those of most species, but the closely related *neodmes* (not known from Costa Rica) has very similar female genitalia though males of that species differ distinctly from *daniloi* in having a narrow uncus and a much broader anellar plate around the aedeagus.

REMARKS. This species is named in honour of Danilo Brenes Madrigal, member of a parataxonomist class at INBio.

BIOLOGICAL NOTES. Moths have been found at altitudes of 600–750 m in Costa Rica (to 1600 m in Peru), in March to May and November (in Costa Rica).

DISTRIBUTION. Costa Rica, Venezuela, Ecuador and Peru.

MATERIAL EXAMINED (16 specimens; including 5 ♂, 3 ♀ genitalia preparations)

Holotype ♂, **Venezuela**: 1 ♂, Aragua, near Maracay, Rancho Grande, 14–28.vi.1991 (*Cook*) (genitalia slide Geom. 15682; BMNH).

Paratypes. Costa Rica: *Alajuela Province*: 2 ♂, 2 km SW. of Dos Ríos, Finca San Gabriel, 600 m, UTM 318800,383500, v.1989 (*GNP Biodiversity Survey*); [*Cartago Province*]: 1 ♀, Juan Viñas, xi (USNM); 1 ♀, Tuis, v (USNM); *Guanacaste Province*: 1 ♀, Rincon National Park, 4 km E. of Casetilla, 750 m 22.v.1982 (*Janzen & Hallwachs*); [*Limón Province*]: 2 ♀, Sixaola River, iii (*Schaus*), iv; (INBio and BMNH unless stated otherwise). **Ecuador**: 1 ♂, 4 ♀, Pichincha, [near Santo Domingo,] Tinalandia, 700 m, 27–30.vi.1980, 19–25.v.1985 (*Covell*) (CVCJ). **Peru**: 1 ♂, Carabaya, La Oroya, c. 900 m, iii.1905 (*Ockenden*) (BMNH); 1 ♂, Divisoria, c. 1600 m, 20–23.vi.1982 (*Covell*) (CVCJ); 1 ♂, Río Inambari, La Oroya, c. 900 m (*Ockenden*) (BMNH).

Lissochlora freddyi sp. n.

(Figs 11, 88, 147, 215, 270, 287)

ADULT (Fig. 11). Fore wing length: ♂, 11–12 mm; ♀, 14 mm.

Wings with white antemedial and postmedial lines reduced to series of dots on the veins, occasionally joined in places by faint wavy lines. Hind wing with veins M3 and CuA1 on common stalk which is occasionally extremely short. Front of fore tibia brownish green or occasionally pale brown; oblique white bar indistinct and usually reduced to a spot, or absent. Abdomen with about 7 white spots; anterior spot (on terga 1) with dark patch on anterior side.

GENITALIA ♂ (Figs 88, 147, 215). Uncus extremely slender and tapered; socii long, similar to uncus. Costal side of valva slightly broadened, width increasing slightly distally, and ending near tip of valva in dense group of spinules aligned across the valva. Juxta with papilla. Coremata absent or not noticeably developed. Aedeagus curved, curvature usually slight; apex of anellar plate slightly scooped.

GENITALIA ♀ (Figs 270, 287). Apophyses anteriores slightly less than half length of apophyses posteriores. Without pouch joining ostium and sternite 7; with or without pair of lightly sclerotized patches at anterior end of sternite 7. Poste-

rior half of corpus bursae lightly striated by fine transverse wrinkles.

DIAGNOSIS. *L. freddyi* is likely to be confused with *daniloi* (see diagnosis of that species) but it is distinguished from that and all other species by a combination of genitalic characters. These characters are: the form of the uncus, socii and distal process of the valva (in the male); the absence of a pouch joining the ostium and sternite 7, and the absence of sclerotization in the corpus bursae (in the female).

REMARKS. This species is named in honour of Freddy Antonio Quesada Quesada, member of a parataxonomist class at INBio.

BIOLOGICAL NOTES. Moths have been found at altitudes of 0–1200 m in January, March, April and July to September.

DISTRIBUTION. Known only from Costa Rica.

MATERIAL EXAMINED (9 ♂, 4 ♀; including 3 ♂, 2 ♀ genitalia preparations)

Holotype ♂, **Costa Rica**: Alajuela Province, 5 km NW. of Dos Ríos, Finca Campana, 750 m, 21.iii.1985 (*Janzen & Hallwachs*) (genitalia slide no. LMP 273; INBio).

Paratypes. Costa Rica: *Alajuela Province*: 4 ♂, 9 km S. of Santa Cecilia, Estacion Pitilla, 700 m, UTM 330200,380200, vii.1988 (*Scoble & Brooks*; *Espinosa & Chaves*), ix.1989 (*Moraga & Rios*); *Limón Province*: 1, Sixaola River, iii (USNM); *Puntarenas Province*: 2 ♂, Osa Peninsula, Corcovado National Park, Sirena, 0–100 m, UTM 270500,508300, 5–11.i.1981 (*Janzen & Hallwachs*), iv.1989 (*Blanco & Fonseca*); 1 ♂, San Vito, Las Cruces Biol. Station, 1200 m, 16–26.iii.1988 (*I. Chacon*); *San José Province*: 1 ♂, 3 ♀, Braulio Carrillo National Park, Estacion Carrillo, 700 m, viii, ix.1984 (*I. Chacon*), vii.1990 (*Pitkin*). (INBio and BMNH unless stated otherwise).

Lissochlora latuta (Dognin) comb. n.

(Figs 12, 89, 148, 216, 288)

Geometra latuta Dognin, 1898: 213. **LECTO-TYPE** ♂, ECUADOR (USNM), here designated [examined].

Racheospila ella Prout, 1912: 105. **Holotype** ♂, COLOMBIA (BMNH) [examined]. **Syn. n.** *Racheospila latuta* (Dognin); Prout, 1932: 30.

ADULT (Fig. 12). Fore wing length: ♂, 12–14 mm; ♀, 14–15 mm.

Wings with wavy white antemedial and postmedial lines. Hind wing with veins M3 and CuA1

on extremely short common stalk. Front of fore tibia mid brown with oblique white bar. Abdomen with up to about 5 white spots but without dark spot.

GENITALIA ♂ (Figs 89, 148, 216). Uncus a short slender rod; socii broadened gradually towards apex, much broader than uncus. Valva with costal side strongly broadened, increasing distally, sometimes extended as a small lobe, and ending abruptly before tip of valva. Juxta with very small papilla. Aedeagus straight or slightly curved; anellar plate fairly small with rounded apex.

GENITALIA ♀ (Fig. 288). Apophyses anteriores half (or slightly less) length of apophyses posteriores. Without pouch joining ostium and sternite 7. Corpus bursae lightly or distinctly sclerotized around opening to ductus bursae.

DIAGNOSIS. *L. latuta* is distinguished from the other Costa Rican species of the *diarita*-group by the unbroken waved antemedial and postmedial lines on its wings and the absence of a small dorsal dark spot at the anterior end of its abdomen. The shape of the male valva and the sclerotization around the opening of the female corpus bursae are distinctive features of this species.

BIOLOGICAL NOTES. Moths have been found at an altitude of 1000 m in Costa Rica (to 3800 m in Colombia), in May (in Costa Rica).

DISTRIBUTION. From Costa Rica to Bolivia.

MATERIAL EXAMINED (19 specimens; including 4 ♂, 2 ♀ genitalia preparations)

Lectotype ♂ (*latuta*), **Ecuador**: Loja area, 1889 (genitalia slide no. 57,579; Type No. 32582; USNM). Holotype ♂ (*ella*), **Colombia**: Torné, viii.1907 (genitalia slide Geom. 15098; BMNH).

Costa Rica: *Cartago Province*: Moravia de Chirripo, 1000 m (INBio). **Colombia**: Cordillera Central, Monte Tolima, 3200, 3500, 3800 m; Cordillera Oriental, Pacho, 2200 m; San Antonio, c. 1800 m; San Cajetano, c. 2450 m; (BMNH). **Ecuador**: 2 ♂ (*latuta* paralectotypes), Loja area, 1889, 1891 (USNM); 1 ♀ (*latuta* paralectotype), near Loja, El Monje, 1893 (USNM). **Peru**: Carabaya, Oconeque, c. 2150 m (BMNH). **Bolivia**: La Paz (BMNH).

Lissochlora ronaldi sp. n.

(Plate 1; Figs 13, 71, 90, 149, 217, 271, 289)

ADULT (Plate 1; Fig. 13). Fore wing length: ♂, 9–11 mm; ♀, 11–13 mm.

Front of head without white marks other than occasional trace of pair in lower corners. Wings with white antemedial and postmedial lines reduced to series of dots on the veins. Hind wing with veins M3 and CuA1 on very short common stalk or just separate. Front of fore tibia brown, usually greenish; pale on outer side, dark brown on inner side; without oblique white bar except occasionally a diffuse pale streak present. Abdomen with small black or dark brown dorsal spot on tergum 1, and 5 or 6 white spots on terga 2–7 (Fig. 71).

GENITALIA ♂ (Figs 90, 149, 217). Uncus short, fairly broad and slightly spatulate; socii slender and tapered at tip. Costal side of valva not strongly broadened and not increasing distally, with short finger-like spinulose distal process extending just beyond tip of valva. Juxta with papilla. Aedeagus curved, usually strongly; anellar plate broad and bulbous.

GENITALIA ♀ (Figs 271, 289). Apophyses anteriores one-quarter to slightly less than one-third length of apophyses posteriores. With large oblong pouch joining ostium and sternite 7; side of pouch adjoining sternite deep and smooth, ostial side of pouch shallow and wrinkled.

DIAGNOSIS. The combination of a dark spot on tergum 1 and white spots on terga 2–7 of the abdomen of *ronaldi* distinguishes it from the other Costa Rican species of the *diarita*-group (in which the black spot is adjoined to the anterior white spot, or is lacking). The shape of the distal process of the male valva and the form of the pouch joining the ostium and sternite 7 in the female are the most distinctive features of this species.

REMARKS. This species is named in honour of Ronald Vargas Castro, member of a parataxonomist class at INBio.

BIOLOGICAL NOTES. Moths have been found at altitudes of 1000–1500 m, in January, May to September, November and December (in Costa Rica).

DISTRIBUTION. Costa Rica and Panama.

MATERIAL EXAMINED (25 specimens; including 4 ♂, 2 ♀ genitalia preparations)

Holotype ♂, **Costa Rica**: *Puntarenas Province*: Monteverde, 1400 m, 10–11.xii.1979 (Janzen) (genitalia slide no. LMP 272; INBio).

Paratypes. **Costa Rica**: *Alajuela province*: 1 ♀, NE. slope of Volcán Poás, 8 km N. of Vara Blanca, 1400 m, 19.vi.1988 (Brown & Powell) (UCB); [*Cartago Province*]: 1 ♂, 1 ♀, Juan

Viñas, c. 750 m, c. 1100 m, 13, 24.i (*Schaus*); 1 ♂, Moravia de Chirripo, 1000 m, 10.v.1983 (*Janzen & Hallwachs*); 3 ♂, Orosi, 1200 m (*Fassl*); 2 ♀, Sitio, v (BMNH; CMNH); 1 ♀, 9 km NW. of Turrialba, near Santa Cruz, Río Aquiares, 1500 m, 16.v.1985 (*Powell & Opler*); *Puntarenas Province*: 7 ♂, 1 ♀, Monteverde, 1350–1430 m, c. 1250 m, 1350 m, 15–16.v.1980, 8.viii.1986, 2.ix.1988, 22–24.vii.1990 (*Janzen & Hallwachs*; *Covell*; *Meredith & Powell*; *Pitkin*;) (INBio; BMNH; CVCJ; UCB); 1 ♂, 1 ♀, 2 km E. Monteverde, 1500 m, 24.vii.1990 (*Meredith & Powell*) (UCB); *San José Province*: 2 ♀, Braulio Carrillo National Park, Estacion Zurquí (el Tunel), 1500 m, 10° 04'N, 84° 01'W, xi.1985 (*I. & A. Chacon*); 1 ♀, 'San Jose', c. 1250 m, xi.1906 (USNM); (INBio and BMNH unless stated otherwise). **Panama**: 1 ♂, Chiriquí (BMNH).

NEMORIA Hübner, 1818

Nemoria Hübner, 1818: 25. Type species: *Nemoria bistriaria* Hübner, 1818, by subsequent designation by Moore, [1887]: 431.

Leptographa Hübner, [1823]: 284. Type species: *Leptographa scriptaria* Hübner, [1823], by subsequent designation by Prout, 1912: 248. [Synonymy queried by Forbes, 1948: 112.] **Syn. n.** *Racheospila* Guenée, 1857: 372. Type species: *Racheospila lixaria* Guenée, 1857, designated by Hulst, 1896: 314. [Synonymized by Forbes, 1948: 112–114.]

Aplodes Guenée, 1857: 376. Type species: *Aplodes mimosaria* Guenée, 1857, designated by Hulst, 1896: 315. [Synonymized by Prout, 1912: 110.]

Hipparchiscus Walsh, 1864: 301. Type species: *Hipparchiscus venustus* Walsh, 1864, by monotypy. [Synonymized by Prout, 1912: 111.]

Anaploides Packard, 1876: 367, 392. Type species: *Anaploides pistaciaria* Packard, 1876, by monotypy. [Synonymized by Prout, 1912: 111.]

Annemoria Packard, 1876: 367, 375. Type species: *Eunemoria unitaria* Packard, 1874, by monotypy. [Synonymized by Ferguson, 1969: 28.]

Blechroma Möschler, 1881: 403. Type species: *Blechroma exertata* Möschler, 1881, by monotypy. [Cited as synonym of *Racheospila* by Prout, 1912: 102.]

Miantonota Warren, 1895: 89; 1897: 425. Type species: *Miantonota integra* Warren, 1897, by subsequent monotypy. [Cited as synonym of *Racheospila* by Prout, 1912: 102.]

Dryadopsis Warren, 1897: 424. Type species: *Racheospila morbilliata* Felder & Rogenhofer, 1875, by original designation. **Syn. n.**

ADULT (Plate 1: 2nd row (right), third row, bottom row; Figs 14–69, 72–82). Generally of medium size for Geometrinae but a few representatives large or small, fore wing length of species that occur in Costa Rica: 12–22 mm; some North American species smaller, minimum fore wing length 8 mm.

Ground colour usually green (a pure shade of green in most Neotropical species, as in Plate 1), sometimes with brown markings. Front of head green accompanied by 2 white marks in lower corners; or front of head brown, commonly with 4 white marks sometimes joined as lower and upper pairs. White interantennal fillet present in most species. Male antennae bipectinate but usually not strongly so: length of longest antennal branches usually up to about twice width of flagellum at same point; occasionally longer: three or four times width of flagellum. Female antennae simple (except *winniae*). Antennae usually with white dorsal line along basal half of flagellum. Outer margins of wings usually distinctly curved as in Figs 14–39, sometimes weakly curved; fore wing tip not produced; hind wing rounded or somewhat angulate. Plain-winged species usually have waved or smooth white antemedial and postmedial lines and reddish brown terminal line, which are absent in most patterned species; waved white antemedial and postmedial lines are sometimes weaker between the veins. Postmedial line of hind wing usually bent at middle (distinctly so in most Neotropical species). Under-side of wings a paler version of upper side. Venation: hind wing with M3 and CuA1 on common stalk (Fig. 68), separate (Fig. 69) or intermediate; Sc+R1 and Rs of hind wing touching but not fused. Front of fore tibia usually with oblique white bar halfway; hind tibia with two pairs of spurs; hind tibia of male dilated, often strongly, and with apical extension. Abdomen commonly with three white dorsal spots which are usually ringed with reddish brown; alternatively with dark brown spots or (rarely in Neotropical species) lacking spots. Predominant dorsal ground colour of abdomen usually green; ventral surface whitish or cream. Sternite 3 of male abdomen with pair of fields of deciduous needle-like modified scales as in most Geometrinae.

GENITALIA ♂ (Figs 91–140, 150–209, 218–267). Uncus slender, usually fairly long and rod-like (as in Fig. 164) but sometimes shorter and spatulate (as in Figs 152, 156, 160); usually extending well beyond socii. Socii semi-membranous, usually erect, well developed in the majority; typically rounded but sometimes triangular with

pointed apex. Gnathos a slender loop with a narrow sharp distal tooth. Valva much longer than broad, basic shape more-or-less parallel-sided but with sclerotized costal margin extended as a basal process and often also as a distal process. Juxta either funnel-shaped with closed papilla or a flat plate. Coremata often present (in most Neotropical species, well developed, often with long extensible membranous sac; usually with dense hair-like tufts. Saccus often notched but sometimes rounded or intermediate. Aedeagus swollen medially or slender, sometimes (infrequently in Neotropical species) with a row of small spines on one side. Anellar plate weakly to well developed; usually extending to middle or two-thirds length of aedeagus, rarely approaching apex. Sternite 8 usually produced posteriorly as two slight rounded lobes with a V-shaped notch between; anterior margin of sternite usually strongly concave; similar in dimensions to tergite or slightly shorter, often squarish; with midrib, usually distinct but occasionally only a trace. Tergite 8 usually slightly rounded, occasionally with shallow posterior excision.

GENITALIA ♀ (Figs 272–279, 290–329, 333–344). Apophyses anteriores (measured to margin of eighth segment) commonly half length of apophyses posteriores, or more, but reduced in some species. Usually (most Neotropical species at least) with lightly or well sclerotized poststrial plate, though this is fused with other structures of ostial region and sometimes ill-defined. Majority of species with somewhat sclerotized and wrinkled pouch joining ostium and sternite 7. Ductus bursae ranging from much shorter than segment 7 to much longer, usually membranous but occasionally with sclerotized antrum. Corpus bursae elongate, usually slender with bulbous anterior end; with ductus bursae adjoining subterminally, ductus seminalis terminally. Anterior end of corpus bursae with fairly small or occasionally broad signum (rarely absent) in form of rounded or rectangular and usually shallow pouch, with well defined line or ridge at opening commonly straight, otherwise curved.

DIAGNOSIS. *Nemoria* is a large and varied genus, difficult to define on external characters. It lacks the distinctive wing pattern and abdominal tuft of *Chavarriella*, and the few *Nemoria* species that have a similar wing pattern to that of the *albociliaria*-group and various other species in *Lissochlora* (brown dots together with tiny white dots confined to the postmedial and antemedial lines) lack the white abdominal spots of that group. The outer margins of the wings are usu-

ally more curved than those of the *diarita*-group of *Lissochlora* but certain other species of *Lissochlora* have a distinctly *Nemoria*-like appearance. Some species of *Nemoria* may be mistaken for *Synchlora* though the latter usually are small moths with strongly bipectinate male antennae, unlike most *Nemoria* species. *Nemoria* also resembles *Phrudocentra* but that genus lacks the reddish-ringed white abdominal spots conspicuous in many species of *Nemoria* and rarely has the dark abdominal spots present in several other *Nemoria* species. The majority of species currently placed in *Phrudocentra* have a straight or only slightly curved postmedial line on the hind wing whereas this line is usually distinctly bent or curved in *Nemoria*. The genus *Chlorosea*, confined to North America, is distinguished from *Nemoria* by the reduction in the number of hindtibial spurs (Ferguson, 1985: 14–15). *Chlorosea* has only the apical pair of spurs (rarely with one reduced preapical spur also) whereas both pairs are present in *Nemoria*.

With few exceptions, *Nemoria* is characterized by the well developed basal costal process of the male valva; a weakly developed process is sometimes seen in certain other genera, such as *Lissochlora*. The rod-like, usually long, uncus also distinguishes *Nemoria* from *Synchlora* and from most species of *Lissochlora*. The shape of the female signum separates *Nemoria* from the externally similar genera discussed above, except perhaps for *Chlorosea* and a few species of *Synchlora*.

REMARKS. The outer margin of the hind wing, usually more or less rounded, is strongly angulate only in *pescadora* and *winniae*. The genitalia of both sexes range from simple to complex; in some species the male basal costal process is as long as the valva. In Neotropical species the basal costal process is least developed in *dorsilinea*, *inaequalis*, *astraea*, *torsilinea*, *punctilinea*, variable in *dentilinea* and lost or modified in *venezuelae* which has an unusual development of the costa of the valva. *N. callirrhoe* is atypical of the *Nemoriini* in having extremely long narrow socii, similar to the uncus; in *lorenae* the socii are also nearly as long as the uncus but broader; *astraea*, unlike other *Nemoria* species, lacks a signum.

Forbes (1948: 112–4) cited *Racheospila* 'in part' as a synonym of *Nemoria* but in combining *lixaria*, the type-species of *Racheospila*, with *Nemoria*, he made the synonymy effective.

BIOLOGICAL NOTES. *Nemoria* larvae feed on the foliage of a variety of trees and shrubs. Some of

the North American species (documented by Ferguson, 1969 and 1985) are generalised feeders, notably *N. mimosaria* for which 21 different deciduous and coniferous hosts have been recorded. However, data available on host plants of the Neotropical fauna is disappointingly limited to a single record of *aturia* reared on leaves of the tree *Nectandra salicina* (Lauraceae). Oaks would be worth investigating as possible hosts of some Central American *Nemoria* species since *Quercus* species, including the white oak (*Q. alba*), are favoured by a number of North American species, and relatives of the white oak group occur as far south as Guanacaste in Costa Rica, with one or two other oak species reaching Colombia.

Summary of known host-plants of *Nemoria*

Host-plants in the following genera were recorded by Ferguson (1969 and 1985) for *Nemoria* specimens reared in North America, unless stated otherwise.

- Aceraceae: *Acer* (sugar maple)
- Anacardiaceae: *Rhus*
- Betulaceae: *Alnus* (alder); *Betula*; *Carpinus* (iron-wood)
- Empetraceae: *Ceratiola*
- Ericaceae: *Arbutus*
- Fagaceae: *Quercus*
- Grossulariaceae: *Ribes*
- Hamamelidaceae: *Liquidambar*
- Juglandaceae: *Juglans*
- Lauraceae: *Nectandra* [Costa Rica, record based on bred specimen here examined]
- Myricaceae: *Myrica*
- Oleaceae: *Fraxinus* (green ash)
- Pinaceae: *Abies* (balsam fir); *Larix* (larch); *Picea* (white spruce); *Tsuga* (eastern hemlock)
- Polygonaceae: *Eriogonum*
- Rhamnaceae: *Ceanothus*
- Rosaceae: *Crataegus* (hawthorn); *Heteromeles*; *Prunus* (choke cherry); *Sorbus* (mountain ash)
- Salicaceae: *Populus* (trembling aspen); *Salix* (willow)
- Tiliaceae: *Tilia* (basswood)
- Ulmaceae: *Ulmus* (American elm)

The larvae of *Nemoria* and other *Nemoriini* have dorsolateral processes which are particularly large on abdominal segments one to five (see Ferguson, 1985: text figure 4a).

Greene (1989) gives a fascinating account of diet-induced polymorphism known in *arizonaria* (Grote), which feeds on several *Quercus* species in southern U.S.A. and northern Mexico. Caterpillars of the spring brood feed on oak catkins

and develop into almost indistinguishable mimics of these, while caterpillars from the summer brood feed on the leaves and develop into twig mimics, totally unlike the catkin morph.

DISTRIBUTION. *Nemoria* is widespread from Canada to Argentina but the genus (and the tribe *Nemoriini* as a whole) is most diverse in the warm temperate to tropical regions of the New World. Ninety-eight species of *Nemoria* occur in the Neotropics whereas only 37 are Nearctic. Just one species, *N. pescadora*, which has been collected from central Mexico and Costa Rica, has been found both in the Nearctic Region and in the Neotropical Region. Further to this distributional division, few species have their closest relatives in the other zoogeographical area.

According to Ferguson (1985), the Geometrinae are noted for the limited distribution ranges of their species. Ferguson considered *Nemoria* species tend to be particularly localised, with two-thirds of those in North America ranging across three states or less. The present study indicates that Neotropical species of *Nemoria* may be more localised than those of other recently studied geometrid genera.

Of the 98 Neotropical species of *Nemoria* only 17% occur both in Central and in South America, and approximately 50% are restricted to South America. The percentage of Neotropical species known from both Central and South America is higher in certain Ennominae: 28% in the *Thysanopyga*-group (studied by Krüger and Scoble, 1992) and 40% in *Phrygonis* Hübner and *Pityjea* Walker (Scoble, in preparation). Similarly, in *Oospila* (studied by Cook, 1993), a geometrine genus not belonging to the tribe *Nemoriini*, this percentage (28%) is higher than that of *Nemoria*.

Almost half (46%) of the 48 Costa Rican species of *Nemoria* are endemic to that country, and Costa Rican populations of several more widespread species may show incipient speciation from the remainder of their range. There are fewer Costa Rican endemics in the *Thysanopyga*-group (33% of the Costa Rican species are endemic), 21% in the ennomine genus *Semiothisa* Hübner (in the course of study by Hua) and 12% in *Oospila*. None of the six Costa Rican species of *Phrygonis* and *Pityjea* are endemic.

The genus *Nemoria* occupies a variety of forest habitats in Costa Rica, ranging from semideciduous tropical dry or moist forest to evergreen tropical rain forest. It is known from coastal lowlands and at elevations of up to about 3000 m.

The pulveraria-group

ADULT. Generally of medium size for the genus although some individuals are smaller. Head without white interantennal fillet (other than indistinct pale patch in some *epaphras*); dorsal area of head green; Antennae lacking the usual unbroken white dorsal line along basal half of flagellum but striated with white instead of this; male antennal branches short. Wing pattern: brown blotches and speckles, often particularly towards costa of fore wing; costa of fore wing with fine transverse striations; without white antemedial and postmedial lines or reddish brown terminal line.

GENITALIA ♂ (Figs 91–95, 150–154, 218–222). Uncus fairly short, often spatulate; socii narrow and often tapered. Juxta without papilla. Coremata consisting of two types: dense brush of thick scales, plus dense brush of fine scales on long sac. Saccus truncate, rounded or notched. Anellar plate extending fairly well towards apex of aedeagus.

GENITALIA ♀ (examined in two species only, Figs 272, 290, 291, 333). With partly sclerotized pouch or with paired sclerotized folds between ostium and sternite 7; ostium flanked by pair of broad sclerotized lobes which are sometimes form continuous lip to ostium. Ductus bursae much shorter than segment 7; signum broad.

DISTRIBUTION. From Guatemala to Brazil, French Guiana and Bolivia.

The *pulveraria*-group comprises seven species, five of which occur in Costa Rica; (see the catalogue of extralimital species for the others).

***Nemoria adjunctaria* (Dyar) comb. n.**

(Figs 22, 72, 91, 150, 218, 272, 290, 333)

Dryadopsis adjunctaria Dyar, 1914: 230. Holotype ♂, PANAMA (USNM) [examined].

Dryadopsis leucaspis Prout, 1932: 40. Holotype ♂, COLOMBIA (BMNH) [examined]. **Syn. n.**

ADULT (Fig. 22). Front of head mid to dark brown; dark brown band between upper pair of white marks and green dorsal area of head. Wing pattern: dark brown blotches and speckles, particularly towards costa of fore wing. Hind wing with veins M3 and CuA1 on very short common stalk. Front of fore tibia: lower three-quarters dark brown, upper part white; oblique white bar usually broken in middle. Abdomen (Fig. 72) with 2 median white dorsal spots (anterior of these large, posterior merely a trace usually)

joined or surrounded by mid to dark brown patch; usually a small dark brown patch at anterior end.

GENITALIA ♂ (Figs 91, 150, 218). Uncus spatulate; socii narrow and tapered. Basal costal process of valva slightly coiled, tapering to a thin extension; about half length of valva; distal process of valva very weakly developed. Anellar plate tapered, usually to a slight notch at apex. Sternite 8 with fairly shallow posterior notch.

GENITALIA ♀ (Figs 272, 290, 333). Apophyses anteriores slightly more than half length of apophyses posteriores. Without pouch joining ostium and sternite 7 but with 2 pairs of stiffened folds in membranous intersegmental region; ostium with large lip extending across sternite. Signum a broad crescent.

DIAGNOSIS. *N. adjunctaria* is the only species in the *pulveraria*-group with a large white spot on the abdomen (Fig. 72).

VARIATION. In the male genitalia the valva is sometimes slightly tapered.

BIOLOGICAL NOTES. Moths have been found at altitudes of 0–700 m in Costa Rica to 800 m in Colombia. They have been collected in July, October and December (in Costa Rica).

DISTRIBUTION. From Guatemala to Colombia.

MATERIAL EXAMINED (29 specimens; including 4 ♂, 2 ♀ genitalia preparations)

Holotype ♂ (*adjunctaria*), **Panama:** Canal Zone, Trinidad River, iii.1912 (Busck) (genitalia slide no. LMP 215; Type No. 16057; USNM). Holotype ♂ (*leucaspis*), **Colombia:** Muzo, 400–800 m (*Fassl*) (genitalia slide Geom. 14155; BMNH).

Guatemala: Cayuga (USNM). **Costa Rica:** *Alajuela Province:* 9 km S. of Santa Cecilia, Estacion Pitilla, 700 m; *Heredia Province:* Puerto Viejo de Sarapiquí, La Selva Biological Station, 40 m; *Limón Province:* 9.4 km W. of Bribri, Suretka, 200 m; Sixaola River; N. edge Tortuguero National Park, Cerro Tortuguero, 0–100 m; *Puntarenas Province:* Osa Peninsula, Corcovado National Park, Sirena; 35 km S. of Palmar Norte, Fila Esquinas, 150 m; *San José Province:* Braulio Carrillo National Park, Estacion Carrillo, 600 m, 700 m (INBio/BMNH; UCB); (INBio and BMNH unless stated otherwise). **Colombia:** (including 1 ♂ *leucaspis* paratype) Muzo, 400–800 m (*Fassl*) (BMNH).

Nemoria anae sp. n.

(Figs 20, 92, 151, 219)

[*Blechroma epaphras* Schaus, 1912: 288 (partim). Misidentification.]

ADULT (Fig. 20). Front of head brown with a few green scales; green dorsal area of head extending onto upper frons. Wing pattern: mid to dark brown blotches and speckles bordered by darkish green; postmedial markings of fore wing forming distinct blotch near costa close to where discal blotch extends towards costa. Hind wing with veins M3 and CuA1 on short common stalk. Front of fore tibia: lower three-quarters dark brown, upper part whitish. Abdomen with 4 tiny plain white dorsal spots, and dull brown area at anterior end.

GENITALIA ♂ (Figs 92, 151, 219). Uncus sometimes slightly spatulate; socii narrow and tapered. Basal costal process of valva slightly coiled, tapering to a long thin extension; about half length of valva. Costal margin of valva irregularly curved, approaching midrib; with fairly small but distinct distal process. Anellar plate tapered, sometimes to a slight notch at apex, extending well towards or reaching apex of aedeagus. Tergite 8 with very slight excision.

♀. Unknown.

DIAGNOSIS. The brown wing markings of *anae* are diffuse and usually fairly thick, very similar to those of *epaphras*, with which it has been confused, but with the costal markings of the fore wing positioned differently. Other members of the *pulveraria*-group usually have finer hind wing markings including some distinct darker dots. The hind wing veins M3 and CuA1 are separate in *epaphras* and stalked in *anae*. The shape of the basal costal process of the male valva (Fig. 151) clearly separates *anae* from all other species in the group except perhaps *adjunctaria* which, unlike *anae*, lacks a distinct distal process of the valva and has a large white spot on the abdomen.

REMARKS. This species is named in honour of Ana Sittenfeld, Director of Biodiversity Prospecting at INBio.

BIOLOGICAL NOTES. Moths have been found at an altitude of 700 m, in September and November.

DISTRIBUTION. Known only from two localities in Costa Rica.

MATERIAL EXAMINED (4 ♂, including 3 genitalia preparations)

Holotype ♂, Costa Rica: Alajuela Province, 9 km S. of Santa Cecilia, Estacion Pitilla, 700 m, UTM 330200,380200, ix.1989 (*Moraga & Rios*) (genitalia slide no. LMP 270; INBio) [examined].

Paratypes. Costa Rica: 2 ♂, locality as holotype, UTM 330200,380200, W85° 25'40", N10° 59'26" (BMNH); San José Province: 1 ♂ (paralectotype of *epaphras*), Carrillo (USNM).

Nemoria epaphras (Schaus) comb. n.

(Plate 1; Figs 21, 93, 152, 220)

Blechroma epaphras Schaus, 1912: 288. LECTO-TYPE ♂, COSTA RICA (USNM), here designated [examined].

Racheospila epaphras Schaus; Prout, 1932: 34.

ADULT (Plate 1; Fig. 21). Front of head: centre green with brown patch at each side; 4 white marks in corners, lower 2 large and partly fused, upper 2 small and sometimes faint; without white interantennal fillet other than indistinct pale patch. Wing pattern: dull brown blotches and speckles bordered by darkish green; postmedial markings of fore wing forming distinct blotch near costa well away from where discal blotch extends towards costa. Hind wing with veins M3 and CuA1 separate. Front of fore tibia: lower three-quarters dark brown, upper part whitish. Abdomen with 4 small plain white dorsal spots.

GENITALIA ♂ (Figs 93, 152, 220). Uncus spatulate; socii fairly narrow. Basal costal process of valva short (about one-quarter length of valva), bluntly rounded; costal margin of valva strongly sinuous, approaching midrib, with fairly slight, rounded or pointed distal process. Anellar plate tapered, sometimes to a slight notch at apex, extending well towards apex of aedeagus. Tergite 8 with very slight excision.

♀. Unknown.

DIAGNOSIS. *N. epaphras* was described from a series which included *anae* and external differences between the two species are subtle, although the costal markings of the fore wing are positioned differently. The major genitalic difference is in the shape of the basal costal process of the male valva (compare Figs 152 and 151).

REMARKS. This species was described from an unspecified number of specimens from Costa Rica: Juan Viñas and Carrillo. I have examined one male from each locality and designate the one from Juan Viñas as lectotype, although it lacks an abdomen; the other specimen, from Carrillo, belongs in *anae*.

BIOLOGICAL NOTES. Moths have been found at altitudes of 1300–1530 m, in January, June, July, October and November (in Costa Rica).

DISTRIBUTION. Costa Rica and Panama.

MATERIAL EXAMINED (24 ♂, including 2 genitalia preparations)

Lectotype ♂, Costa Rica: [Cartago Province,] Juan Vías, vi (Type No. 17721; USNM).

Costa Rica: *Cartago Province*: Río Grande de Orosi, Tapanti, 1300–1400 m, 9° 46', x 83° 50'; *Guanacaste Province*: Volcán Cacao, W. side, Estacion Cacao, Derrumbe, 1400 m; *Heredia Province*: 8.2 km downhill Vara Blanca, El Angel waterfall, 1350 m; *Puntarenas Province*: 2 km E. of Monteverde, 1530 m; 11 km NW. of Monteverde, Las Nubes; *San José Province*: Braulio Carrillo National Park, Estacion Zurquí (el Tunel), 1500 m; (INBio and BMNH). Panama: Chiriquí (BMNH).

Nemoria eugeniae sp. n.

(Figs 17, 18, 94, 153, 221)

ADULT (Figs 17, 18). Front of head tan or chestnut brown with 2 large white marks, usually almost merged, in lower corners. Wing pattern: dark brown blotches and speckles, particularly towards costa of fore wing; inner margin of hind wing with two well defined dark brown blotches or a single long blotch. Hind wing with veins M3 and CuA1 separate. Front of fore tibia: lower two-thirds (or more) dark brown, upper one-third white. Abdomen with small, sometimes indistinct, dark brown dorsal spot at anterior end and long patch towards posterior end; with up to four tiny white dorsal spots.

GENITALIA ♂ (Figs 94, 153, 221). Uncus spatulate; socii narrow and tapered. Basal costal process of valva short (one-quarter to one-third length of valva), bluntly rounded or almost pointed; costal margin of valva curved but not approaching midrib, with rounded distal process. Anellar plate tapered, sometimes to a slight notch at apex. Sternite 8 with posterior lobes fairly close together or very weakly notched.

♂. Unknown.

DIAGNOSIS. *N. eugeniae* is easily recognised by the form of its hind wing blotches. The male genitalia are similar to those of *epaphras* but the costal margin of the valva is well separated from the midrib in *eugeniae* whereas it curves in close to the midrib in *epaphras*.

REMARKS. This species is named in honour of

Eugenia León, Director of Administration at INBio.

BIOLOGICAL NOTES. Moths have been found at altitudes of 1300–1450 m, in January, May to August and December.

DISTRIBUTION. Known only from Costa Rica.

MATERIAL EXAMINED (12 ♂, including 2 genitalia preparations)

Holotype ♂, Costa Rica: *Cartago Province*: Río Grande de Orosi, Tapanti, 1300–1400 m, 9° 46'x 83° 50', 23.i.1985 (Janzen & Hallwachs) (genitalia slide no. LMP 269; INBio).

Paratypes. Costa Rica: *Alajuela Province*: 1 ♂, N. slope of Volcán Poás, 8 km N. of Vara Blanca, 1450 m, 25–26.vii.1990 (Meredith & Powell) (UCB); *Heredia Province*: 2 ♂, 8.2 km downhill Vara Blanca, El Angel waterfall, 1350 m, 3.i.1981 (Janzen & Hallwachs); *Puntarenas Province*: 4 ♂, Monteverde, 29–30.vii.1978, 23–25.viii.1978, 15–16.v.1980 (Janzen & Hallwachs); 4 ♂, Monteverde, 1400 m, 12–15.vi.1974, 10–11.xii.1979, 25–26.vi.1979 (Janzen; Watson); (INBio and BMNH unless stated otherwise).

Nemoria tickelli sp. n.

(Plate 1; Figs 23, 73, 95, 154, 222, 291, 334)

ADULT (Plate 1; Fig. 23). Front of head tan, often with a few green scales; green dorsal area of head extending onto upper frons. Wing pattern: dark brown and tan blotches and speckles, particularly towards costa of fore wing. Hind wing with veins M3 and CuA1 on short common stalk or just meeting. Front of fore tibia: lower three quarters dark brown, upper one quarter white; oblique white bar often broken in middle. Abdomen (Fig. 73) with 4 tiny white dorsal spots, first and last surrounded by dark brown; up to 4 more brown dots towards posterior end.

GENITALIA ♂ (Figs 95, 154, 222). Socii narrow and tapered to a point. Basal costal process of valva very slender and rod-like, pointed, bent at middle, much longer than valva; valva fairly slender, without distal process. Anellar plate tapered, sometimes to a slight notch at apex, extending well towards apex of aedeagus. Sternite 8 with slight posterior notch.

GENITALIA ♀ (Figs 291, 334). Apophyses anteriores slightly more than half length of apophyses posteriores. Large crescent shaped pouch joining ostium and sternite 7 with sclerotized sides forming pair of lobes at edge of sternite; ostium flanked by broad lobes. Ostial structures seen as series of paired pouches and folds when genitalia

are fully extended from sternite. Signum straight with shallow pouch.

DIAGNOSIS. *N. tickelli* can be distinguished from other members of the *pulveraria* group by the brown dots towards the posterior end of its abdomen (Fig. 73) but its most distinctive feature is the long basal process of the male valva (Fig. 154), which can be seen without dissection. *N. eugeniae* has a long brown patch towards the end of abdomen instead of separate spots; besides which, that species has distinctive hind wing markings (Figs 17, 18).

REMARKS. This species is named in honour of Sir Crispin Tickell, in recognition of his role in international environmental concerns.

BIOLOGICAL NOTES. Moths have been found at altitudes of 700–1100 m, in January to March, May to September and December.

DISTRIBUTION. Known only from Costa Rica.

MATERIAL EXAMINED (18 ♂, 4 ♀; including 2 ♂, 2 ♀ genitalia preparations)

Holotype ♂, **Costa Rica:** San José Province, Braulio Carrillo National Park, Estacion Carrillo, 700 m, viii.1984 (*I. Chacon*) (INBio).

Paratypes. **Costa Rica:** *Alajuela Province:* 4 ♂, 2 ♀, 9 km S. of Santa Cecilia, Estacion Pitilla, 700 m, UTM 330200, 380200, W85° 25'40", N10° 59'26", v.1988, 27.i–4.ii, iii, v, ix.1989 (*Moraga & Rios; GNP Biodiversity Survey*); *Cartago Province:* 1 ♂, Moravia de Chirripo, 1000 m, 10.v.1983 (*Janzen & Hallwachs*); *Guanacaste Province:* 5 ♂, 1 ♀, Rincon National Park, 4 km E. of Casetilla, 750 m, 6.vi, 14.viii.1981, 22.v.1982 (*Janzen & Hallwachs*); 1 ♂, Volcán Cacao, SW. side, Estacion Cacao, 1060 m, 18–20.viii.1990 (*Pitkin*); *San José Province:* 6 ♂, 1 ♀, Braulio Carrillo National Park, Estacion Carrillo, 700 m; vii, viii, xii.1984, i.1985, vii.1990 (*I. Chacon; Pitkin*); (INBio and BMNH).

The *erina*-group

ADULT. Medium-sized to large for the genus; fore wing length of Costa Rican species: ♂, 16–22 mm; ♀, 18–22 mm.

Head without white interantennal fillet; dorsal area of head green. Wings without white antemedial and postmedial lines but with some faint brown markings in place of these; without reddish brown terminal line. Hind wing with veins M3 and CuA1 on short common stalk. Abdomen without white dorsal spots but usually with one or more dark brown spots.

GENITALIA ♂ (Figs 96, 97, 155, 156, 223, 224). Uncus usually spatulate though very weakly so in *erina*. Socii small. Basal costal process of valva short (about one-quarter length of valva or less); valva slightly curvaceous with free end usually weakly broadened, truncate and slanting. Juxta without papilla. Coremata consisting of two types: dense brush of fairly thick scales which may be enclosed completely in eversible ovoid sac, plus dense brush of long fine scales on long sac. Saccus usually notched, occasionally truncate.

GENITALIA ♀ (Figs 273, 274, 292, 293). Apophyses anteriores more than half length of apophyses posteriores. Without pouch joining ostium and sternite 7. Ductus bursae much shorter than segment 7; corpus bursae with large bulbous part; signum broad.

DISTRIBUTION. Widespread in the Neotropical Region.

The *erina*-group comprises five species, two of which occur in Costa Rica; (see the catalogue of extralimital species for the others).

Nemoria erina (Dognin) **comb. n.**

(Figs 39, 96, 155, 223, 273, 292)

Achlora erina Dognin, 1896: 143. **LECTOTYPE** ♂, ECUADOR (USNM), here designated [examined].

Rhodochlora erina ab. *bipunctata* Dognin, 1908a: 17. [Infrasubspecific name.]

Racheospila erina (Dognin); Prout, 1932: 29.

ADULT (Fig. 39). Fore wing length: ♂, 16–22 mm; ♀, 18–22 mm.

Front of head mottled fawn, sometimes mixed with dark brown; antennae with at most traces of dotted white dorsal line along flagellum. Wing pattern: dark brown or blackish squiggly blotch at apex of fore wing, at end of postmedial line. Antemedial and postmedial lines very faint dark brown (only just discernible in most Costa Rican specimens), strongly wavy; postmedials more distinct on the veins as dots, with tiny indistinct white dots on outer side (at least on hind wings). Front of fore tibia: lower two-thirds dark brown, upper part pale green; oblique white bar often broken in middle. Abdomen with large mottled dark and pale brown dorsal patch at anterior end, occasionally with one or two small brown median tergal spots.

GENITALIA ♂ (Figs 96, 155, 223). Uncus fairly thick; socii not normally erect. Basal costal process of valva short (about one-quarter length of

valva), largely fused with valva, bluntly rounded; valva without distal process; valva shape similar to that of *punctilinea* but much less pronounced.

GENITALIA ♀ (Figs 273, 292). Signum broad.

DIAGNOSIS. *N. erina* is distinctive on account of its large size together with the dark blotch at the apex of the fore wing (Fig. 39).

BIOLOGICAL NOTES. Moths have been found at altitudes of 800–1700 m in Costa Rica (60 m (in Brazil) to 2700 m (in Peru)), in February, May, June and November (in Costa Rica).

DISTRIBUTION. Widespread from Mexico to Brazil, French Guiana and Bolivia.

MATERIAL EXAMINED (174 specimens; including 1 ♂, 1 ♀ genitalia preparations)

Lectotype ♂, **Ecuador**: Loja area, Zamora, 1893 (Dognin Collection) (Type No. 32591; USNM).

Mexico: Veracruz, Misantla (BMNH). **Guatemala**: (CMNH). **Costa Rica**: *Alajuela Province*: 5 km N. Col. Palmarena, San Ramón Forest Reserve, Río San Lorencito, 800 m; [*Cartago Province*:] Azahar de Cartago, 1550–1850 m; Juan Viñas, 750 m; Moravia de Chirripo, 1000 m; Orosi, 1200 m; Sitio; *Puntarenas Province*: P. N. Amistad, Est. Las Mellizas, Fca Cafrosa, 1300 m, UTM 316100,596100; Monteverde; San Vito, Las Cruces Biol. Station, 1200 m; *San José Province*: 16 km N. of San Isidro del General, 1700 m; (INBio and BMNH unless stated otherwise). **Panama** (USNM). **French Guiana**: St Jean du Maroni (BMNH). **Venezuela**: Aragua, near Maracay, Rancho Grande, 1100 m (CVCJ; BMNH). **Colombia**: Cañón del Tolima, 1700 m; Muzo, 400–800 m; upper ('Ob.') Río Negro, 800 m; (BMNH). **Ecuador**: Pichincha province, [near Santo Domingo,] Tinalandia, 700 m (CVCJ/BMNH). **Peru**: Amazonas, Chachapoyas; Carabaya, Agualani, c. 2700 m; Carabaya, Río Inambari, La Oroya, c. 950 m; Carabaya, Santo Domingo, c. 1250 m, 1850 m, 2000 m; Chanchamayo, La Merced, c. 900–1250 m; Huambo; Pasco, Huancabamba, c. 2100 m, 1850–3100 m; San Gabán, c. 750 m; River Tabaconas, c. 1850 m; Utcuyacu, c. 1550 m; (BMNH). **Bolivia**: 2000 m (BMNH). **Brazil**: Mato Grosso State (BMNH); Parana, Castro (BMNH); *Rio de Janeiro State*: Pico d'Itatiaia (BMNH); Teresopolis (BMNH); *Santa Catarina*: Blumenau, Rio Laeiss (BMNH); Hansa Humboldt, 60 m (BMNH); hills between Hansa and Jaragua, 400 m (BMNH); Jaragua do Sul (BMNH); Joinville (BMNH); Rio Vermelho vic., Sao Bento do Sul (CVCJ/BMNH); [*Sao Paulo*]: Santos, Alto da Serra, 800

m (BMNH); Serra do Cubotas (BMNH).

Nemoria punctilinea (Dognin) comb. n.

(Figs 38, 78, 97, 156, 224, 274, 293)

Miantonota punctilinea Dognin, 1902: 337. Holotype ♂, VENEZUELA: (USNM) [examined]. *Racheospila punctilinea* (Dognin); Prout, 1932: 29.

ADULT (Fig. 38). Fore wing length: ♂, 16–18 mm; ♀, 18–20 mm.

Front of head mottled reddish, mid or darkish brown, upper part green; usually with 2 diffuse white marks in lower corners. Antennae with weak white dorsal line along flagellum. Wing pattern: antemedial and postmedial lines strongly waved but broken into scattered diffuse reddish and dark brown speckles; tiny indistinct white dots on outer side of brown vein dots on lines of hind wing, and of hind part of fore wing. One specimen (Trinidad) with extensive diffuse brown patches on fore wings. Front of fore tibia: lower half mid to dark brown or brownish green, upper part pale green; oblique white bar often indistinct or reduced to a patch. Abdomen with dark brown or black dorsal spots: 1 median, usually plus tiny spot at anterior end of abdomen (male, Fig. 78); tiny spot absent in most Brazilian specimens; female with large patch at anterior end of abdomen.

GENITALIA ♂ (Figs 97, 156, 224). Uncus strongly spatulate, sometimes fairly short. Basal costal process of valva extremely small; valva slightly or distinctly curvaceous with free end truncate, slanting and broadened. Anellar plate indistinct, extending more or less to apex of aedeagus. Sternite 8 with slightly pointed posterior lobes.

GENITALIA ♀ (Figs 274, 293). Signum fairly broad.

DIAGNOSIS. The absence of a dark apical blotch on the fore wing distinguishes *punctilinea* from *erina*, but *punctilinea* may be confused with *parcipuncta* (which does not occur in Costa Rica). In *punctilinea* the postmedial speckles run parallel to the fore wing margin whereas in *parcipuncta*, which is usually more strongly speckled, the line of speckles is a strong curve, not parallel to the wing margin. In the male genitalia the curvature of the valva is generally more pronounced in *punctilinea* than in other species of this group. The female genitalia are very similar to those of *erina*.

REMARKS. 3 ♂, 2 ♀ paralectotypes of *par-*

cupuncta from French Guiana are *punctilinea*, including one which bears the USNM Type No. 32593 (see discussion under *parcupuncta* in the catalogue of extralimital species).

BIOLOGICAL NOTES. Moths have been found from sea level to altitudes of 1400 m, in January, March, May, June, August, September and November (in Costa Rica).

DISTRIBUTION. Neotropical Mexico; Costa Rica to Brazil, Bolivia and French Guiana.

MATERIAL EXAMINED (137 specimens; including 3 ♂, 1 ♀ genitalia preparations)

Holotype ♂, **Venezuela:** Mérida (genitalia slide no. 57,600; Type No. 32594; USNM).

Mexico: Jalapa; Orizaba; Veracruz, Misantla; (BMNH). **Costa Rica:** *Alajuela Province:* 2 km SW. of Dos Ríos, Finca San Gabriel, 600–650 m; 9 km S. of Santa Cecilia, Estacion Pitilla, 700 m, UTM 330200,380200; [*Cartago Province:*] Juan Viñas, c. 750 m; Sitio; *Guanacaste Province:* Rincon National Park, 4 km E. of Casetilla, 750 m; Santa Rosa National Park; Volcán Cacao, SW. side, Estacion Cacao, 1100 m; Volcán Cacao, W. side, Estacion Cacao, Derrumbe, 1400 m; *Heredia Province:* Puerto Viejo de Sarapiquí, Finca La Selva (OTS), 50 m; *Limón Province:* Tortuguero National Park, Cerro Tortuguero, 100 m, UTM 285000,588000; *Puntarenas Province:* Carara Biological Reserve, Estacion Quebrada Bonita, 50 m, UTM 194500,469850; Monteverde; Osa Peninsula, Corcovado National Park, Sirena, 0–100 m, UTM 270500,508300; 35 km S. of Palmar Norte, Fila Esquinas, 150 m, 8° 45' x 83° 20'; *San José Province:* Braulio Carrillo National Park, Estacion Carrillo, 700 m; Braulio Carrillo National Park, La Montura, 1100 m; [S. of San José.] Candelaria Mts; (INBio and BMNH). **French Guiana:** St Jean du Maroni (BMNH); 3 ♂, 2 ♀ (*parcupuncta* paralectotypes), St Laurent du Maroni (USNM). **Trinidad:** Arima Valley (BMNH). **Venezuela:** Aragua, near Maracay, Rancho Grande; Caracas; San Esteban; (BMNH). **Colombia:** upper ('Ob.') Río Negro, 800 m (BMNH). **Ecuador (CM).** **Peru:** Huambo (BMNH). **Bolivia:** Santa Cruz, Provincia del Sara, 450 m (BMNH). **Brazil:** *Amazonas:* Fonte Boa; Rio Madeira; *Rio de Janeiro:* Corcovado Forest; Teresopolis; *Santa Catarina:* Blumenau, Rio Laeiss; hills between Hansa and Jaragua, 400 m; Jaragua do Sul; Nova Brémen, 250 m; Rio Vermelho; [*Sao Paulo*]: Serra do Cubotas; Santos, Alto da Serra, 800 m; (BMNH).

The *scriptaria*-group

ADULT. Generally medium-sized for the genus although *hazela* (Fig. 19) fairly small. With or without white interantennal fillet. Wing pattern: dark brown blotches and speckles (ranging from faint in *aturia* to near solid dark brown in *pentthica*; bands, not speckles in *ozalea*); bases of wings dark in most species. Fore wing: costa without fine striations; brown speckles usually form whorl around discal spot (whorl sometimes indistinct; only an occasional trace in *elbae*). Wings without white antemedial and postmedial lines or reddish brown terminal line (although *oppleta* and *conflua* have dark brown terminal lines and *pulverata* has a diffuse line). Abdomen with brown dorsal markings, sometimes faint, but without distinct white spots.

GENITALIA ♂ (Figs 98–103, 157–162, 225–230). Uncus often slightly spatulate and fairly short; socii usually more triangular than rounded. Juxta without papilla. Coremata often consisting of two types: dense brush of thick scales, plus dense brush of fine scales on long sac (clearly differentiated in some species; less distinctly or not differentiated in others). Saccus truncate, rounded or slightly notched. Sternite 8 often with fairly to extremely deep posterior notch between tapered lobes which project distinctly.

GENITALIA ♀ (examined in three species only, Figs 275, 294–296, 335, 336). Apophyses anteriores short, about one-quarter (or less) length of apophyses posteriores. Pouch joining ostium and sternite 7 a shallow crescent; ostium flanked by pair of small or broad sclerotized lobes. Ductus bursae much shorter than segment 7.

DISTRIBUTION. From Neotropical Mexico to Brazil, French Guiana and Bolivia.

The *scriptaria*-group includes 13 species, five of which occur in Costa Rica; (see the catalogue of extralimital species for the others).

Nemoria aturia aturia (Druce) comb. n.

(Figs 14, 98, 99, 157, 158, 225, 226, 294, 295, 335)

Geometra aturia Druce, 1892: 84. **LECTOTYPE** ♂, MEXICO (USNM), here designated [examined].

Racheospila puntillada Dognin, 1893: 81. **LECTOTYPE** ♂, ECUADOR (USNM), here designated [examined]. **Syn. n.**

Blechroma tistigmaria Dyar, 1912: 91. Holotype ♂, MEXICO (USNM) [examined]. **Syn. n.**

Racheospila magnidiscata Prout, 1912: 108.

Holotype ♂, GUATEMALA (BMNH)

[examined]. [Synonymized by Prout, 1913b: 71 (with *tisstigmata*).]

Racheospila aturia (Druce); Prout, 1932: 34.

ADULT (Fig. 14). Front of head tan brown with 2 white marks, almost merged, in lower corners. Broad white interantennal fillet, occasionally with narrow tan band at hind edge, and green area behind. Wing pattern: scattered dark brown speckles, sometimes faint. Hind wing with veins M3 and CuA1 on common stalk, meeting or separate. Front of fore tibia straw to dark brown; oblique white bar sometimes reduced or indistinct. Abdomen with up to 3 small dark brown dorsal spots which are sometimes faint or even indiscernible.

GENITALIA ♂ (Figs 98, 99, 157, 158, 225, 226). Uncus usually slightly spatulate, fairly short; socii triangular with pointed or rounded apex. Basal costal process of valva slightly coiled, tapered; about half to two-thirds length of valva; valva with swollen and rounded costal margin at free end or free end evenly broadened. Coremata differentiated into two types; long narrow sac less conspicuous than thick brush of coremata. Aedeagus tapered, sometimes to a sharp point. Tergite 8 with shallow excision.

GENITALIA ♀ (Figs 294, 295, 335). Signum a small pouch with opening surrounded by wrinkles.

DIAGNOSIS. *N. a. aturia* tends to be weakly speckled and is thus unlikely to be confused with other Costa Rican members of the *scriptaria*-group. The slightly coiled basal process of the male valva (Figs 157, 158) is a feature shared by *scriptaria* but the valva is shaped differently in that species (Fig. 162).

VARIATION. The dark markings on the wings vary from faint to distinct, with or without dots where the veins end at the wing margin. The strongly marked *a. scotocephala*, which does not occur in Costa Rica, is probably merely an extreme form of this variation. The notch in male sternite 8 ranges from fairly deep to extremely deep (Figs 98, 99) and the anterior end of the aedeagus varies in length and width. In females the pair of sclerotized lobes flanking the ostium vary in length (Figs 294, 295).

BIOLOGICAL NOTES. Host plant: one specimen examined had been bred from a larva on *Nectandra salicina* (Lauraceae) in Costa Rica (Monteverde). Moths have been found at altitudes of 630–2350 m in February, March, June to December (in Costa Rica).

DISTRIBUTION. From Neotropical Mexico to Ecuador.

MATERIAL EXAMINED (73 specimens, including 12 ♂, 4 ♀ genitalia preparations)

Lectotype ♂ (*aturia*), **Mexico**: [Veracruz.] Jalapa (coll. Schaus) (genitalia slide no. 57,599; USNM). Lectotype ♂ (*puntillada*), **Ecuador**: Loja area, 1889 (genitalia slide no. 57,591; Type No. 32595; USNM). Holotype ♂ (*tisstigmata*), **Mexico**: [Veracruz.] Misantla, v.1910 (Müller) (genitalia slide no. 57,569; Type No. 14288; USNM). Holotype ♂ (*magnidiscata*), **Guatemala**: Volcán de Atitlán, c. 750–1100 m ('2500–3500 ft') (*Champion*) (genitalia slide Geom. 13265; BMNH).

Mexico: Jalapa (BMNH); Veracruz, 6 km SW. of Banderilla (UCB); Veracruz, 6 km NW. of Jalapa, San Andres (UCB). **Guatemala**: 'Vera Paz, Pancina' (BMNH). **Costa Rica**: *Alajuela Province*: 7 km NW. Dos Ríos, El Ensayo, Finca La Campana, 700 m; 5 km NW. of Dos Ríos, Finca Campana, 750 m; 16 km E. of Quebrada Grande, Finca San Gabriel, 630 m; 9 km S. of Santa Cecilia, Estacion Pitilla, 700 m, UTM 330200,380200; Volcán Poás, 2350 m; [*Cartago Province*:] Cachi; Juan Viñas; *Guanacaste Province*: Rincon National Park, 4 km E. of Casetilla, 750 m; Volcán Cacao, SW. side, Estacion Cacao, 1100 m; Volcán Cacao, W. side, Estacion Cacao, Derrumbe, 1400 m; *Puntarenas Province*: Monteverde, 1300–1400 m, c. 1350 m; San Vito, Las Cruces Biol. Station, 1200 m; *San José Province*: Braulio Carrillo National Park, Estacion Carrillo, 700 m; (INBio and BMNH). **Panama**: Volcán de Chiriquí, c. 600–900 m, 900–1250 m (BMNH). **Colombia**: Popayán (BMNH). **Ecuador**: Carchi, Chical, 1250 m (CMNH); 1 ♂ (*puntillada* paralectotype), Loja area (USNM); Chimborazo, 11 km NE. of Pallatanga, 2800 m (CMNH).

Nemoria elbae sp. n.

(Figs 15, 100, 159, 227)

ADULT (Fig. 15). Front of head reddish brown, 2 white, merged marks in lower corners; area behind broad white interantennal fillet reddish brown. Antennae lacking white dorsal line along flagellum. Wing pattern: scattered speckles, fairly sparse; fore wing with dark brown blotch at apex; discal spot displaced slightly towards costa on fore wing, absent on hind wing; fringes a warm shade of straw. Hind wing with veins M3 and CuA1 separate, sometimes only just. Front of fore tibia pale or reddish brown without oblique white bar. Abdomen with large chestnut

or black dorsal patch at base, extended as an arch on thorax, plus tiny faint median spot.

GENITALIA ♂ (Figs 100, 159, 227). Uncus sometimes slightly spatulate, fairly short or of standard length; socii triangular, pointed at apices. Basal costal process of valva irregularly produced, towards pointed tip, in a small finely spinulose and occasionally jagged lobe; whole process half to two-thirds length of valva. Valva with swollen and rounded costal margin at free end. Coremata differentiated into two types; long (extensible) sac narrow, less conspicuous than thick brush of coremata. Aedeagus tapered to a sharp point. Anellar plate tapered to a small lobe at apex. Sternite 8 with posterior margin deeply notched; tergite 8 with shallow excision.

♂. Unknown.

DIAGNOSIS. The apical blotch on the fore wing and (in fresh specimens) the straw coloured fringe are distinctive features of *elbae*. In other members of the *scriptaria*-group, which lacks a red terminal line, the fringe is similar in colour to the wing. In the male genitalia the basal costal process of the valva of *elbae*, although somewhat variable, is uniquely shaped (Fig. 159).

REMARKS. This species is named in honour of Elba Ester López Guadamuz, member of the first female parataxonomist class at INBio.

BIOLOGICAL NOTES. Moths have been found at altitudes of 1300–1500 m, in January, April, June to August, October and November.

DISTRIBUTION. Known only from Costa Rica.

MATERIAL EXAMINED (11 ♂, including 3 genitalia preparations)

Holotype ♂, **Costa Rica:** Cartago Province, Río Grande de Orosi, Tapanti, 1300–1400 m, 9° 46' x 83° 50', 7.xi.1982, (Janzen & Hallwachs) (genitalia slide no. LMP 261; INBio).

Paratypes. **Costa Rica:** *Cartago Province:* 5 ♂, locality as holotype, 17.xi.1982, 9.iv.1984, 23.i.1985 (Janzen & Hallwachs); 1 ♂, Tapanti, Campamiento Pejibaye, 1400 m, 21.iv.1988 (*I. Chacon*); *Guanacaste Province:* 1 ♂, Volcán Cacao, W. side, Estacion Cacao, Derrumbe, 1400 m, 5.vi.1988 (Janzen & Hallwachs); *Heredia Province:* 1 ♂, 8.2 km downhill Vara Blanca, El Angel waterfall, 1350 m, 5.viii.1981 (Janzen & Hallwachs); *Puntarenas Province:* 1 ♂, Monteverde, 1300–1400 m, 20–21.vii.1982 (Janzen & Hallwachs); *San José Province:* 1 ♂, Braulio Carrillo National Park, Estacion Zurquí (el Tunel), 1500 m, 10° 04'N, 84° 01'W, x.1985 (*I. & A. Chacon*). (INBio and BMNH.)

Nemoria hazelae sp. n.

(Figs 19, 101, 160, 228)

ADULT (Fig. 19). Fore wing length: ♂, 12–13 mm.

Front of head greenish brown with 2 small white marks in lower corners. White interantennal fillet with green area behind. Antennae lacking white dorsal line along flagellum. Wing pattern: brown blotches and speckles; fringes pale green; fore wing with large central mottled brown area. Hind wing with veins M3 and CuA1 on short common stalk, rarely meeting. Front of fore tibia dark brown with white upper tip; oblique white bar usually broken in middle or reduced. Abdomen dark brown at anterior end of dorsal surface, with several diffuse brown spots.

GENITALIA ♂ (Figs 101, 160, 228). Uncus slightly spatulate, fairly short. Socii narrow and tapered to a point. Basal costal process of valva short (about one-third length of valva), tapered to a sharp point; valva more or less parallel-sided with rounded tip, narrow, without distal process. Juxta without papilla. Sternite 8 with widely spaced posterior lobes and shallow to fairly deep notch; tergite 8 with shallow excision.

♀. Unknown.

DIAGNOSIS. *N. hazelae* has a fairly small wingspan and a characteristic densely speckled fore wing (Fig. 19). It is similar to the larger *consersa* (see catalogue of extralimital species), which has a more diffuse or patchy fore wing pattern and a broader valva in the male genitalia.

REMARKS. This species is named in honour of Ana Hazel Gutierrez Montenegro, member of the first female parataxonomist class at INBio.

BIOLOGICAL NOTES. Moths have been found at altitudes of 0–1200 m, in January, August and November.

DISTRIBUTION. Known only from the Pacific side of Costa Rica: west-central to south.

MATERIAL EXAMINED (10 ♂, including 2 genitalia preparations)

Holotype ♂, **Costa Rica:** Puntarenas Province, 1 ♂, Osa Peninsula, Corcovado National Park, Sirena, 10–19.viii.1980 (Janzen & Hallwachs) (genitalia slide no. LMP 260; INBio).

Paratypes. **Costa Rica:** *Puntarenas Province:* 6 ♂, same locality as holotype, 10–19.viii.1980, 5–11.i.1981 (Janzen & Hallwachs), 0–100 m, UTM 2705000,508300, i.1990 (*Fonseca*); 2 ♂, San Vito, Las Cruces Biol. Station, 1200 m,

xi.1987 (*I. Chacon*); *San José Province*: 1 ♂, Carara Biological Reserve, Estacion Bijagual, 500 m, UTM 192250,474760 xi.1989 (*Zúñiga*). (INBio and BMNH.)

***Nemoria ozalea* (Prout) comb. n.**

(Figs 42, 102, 161, 229)

Racheospila ozalea Prout, 1932: 35. Holotype ♂, COSTA RICA (BMNH) [examined].

ADULT (Fig. 42). Front of head brown, sometimes with 2 white marks in lower corners. Interantennal fillet green with much darker green area behind; antennae lacking white dorsal line along flagellum. Wing pattern: ochreous/tawny brown blotches and bands, heavy in costal half of fore wing; narrow brown band near but not at outer margins, sharply angled in hind wing. Fore wing with black line along outer end of discal cell extending onto veins M1 to M3, in place of discal spot; hind wing without discal spot. Hind wing with veins M3 and CuA1 meeting or on extremely short common stalk. Front of fore tibia mid brown with white tips. Abdomen with scattered brown dorsal patches.

GENITALIA ♂ (Figs 102, 161, 229). Socii triangular, pointed at apices. Basal costal process of valva slender and short (less than one-quarter length of valva); valva regularly parallel-sided, without distal process. Juxta without papilla. Sternite 8 with slightly pointed posterior lobes widely spaced; tergite 8 with shallow excision.

♀. Unknown.

DIAGNOSIS. The wing pattern, with a narrow brown band towards the margin (Fig. 42), is one of the most distinctive in *Nemoria*. The male genitalia are not easily characterized but have a shorter basal costal process of the valva than in other Costa Rican members of the *scriptaria*-group.

BIOLOGICAL NOTES. Moths have been found at altitudes of 600–1400 m, in April and July.

DISTRIBUTION. Costa Rica.

MATERIAL EXAMINED (28 ♂, including 1 genitalia preparation)

Holotype ♂, **Costa Rica**: [Cartago Province, Orosi, 1200 m (*Fassl*) (genitalia slide Geom. 12870; BMNH).

Costa Rica: *Alajuela Province*: 5 km N. of Col. Palmarena, San Ramón Forest Reserve, 900 m; locality as before, Río San Lorencito, 800 m; 5 km NW. of Dos Ríos, Finca Campana, 750 m; 16 km E./ENE. of Quebrada Grande, Finca San

Gabriel, 600–650 m; 9 km S. of Santa Cecilia, Estacion Pitilla, 700 m; *Cartago Province*: Moravia de Chirripo, 1000 m; 2 ♂ (paratypes), Orosi, 1200 m; Río Grande de Orosi, Tapanti, 1300–1400 m; *Guanacaste Province*: Rincon National Park, 4 km E. of Casetilla, 750 m; *Heredia Province*: 8.2 km downhill Vara Blanca, El Angel waterfall, 1350 m; *San José Province*: Braulio Carrillo National Park, Estacion Carrillo, 700 m; Braulio Carrillo National Park, La Montura, 1100 m. (INBio and BMNH.)

***Nemoria scriptaria* Hübner comb. n.**

(Figs 16, 103, 162, 230, 275, 296, 336)

Phal[aena] Geomet[ra] viridaria Stoll, [1790]: 146; pl. 32, fig. 5. Types(s), 'Kaap de goede Hoop' [erroneous] (lost). [Junior homonym of *[Phalaena viridaria]* Clerk, 1759.]

Leptographa scriptaria Hübner, [1823]: 284. [Replacement name.]

Blechroma exertata Möschler, 1881: 404. Holotype ♂, SURINAM (MNHU) [examined]. **Syn. n.**

Racheospila radiolinea Prout, 1916: 164. Holotype ♂, BRAZIL (BMNH) [examined]. **Syn. n.**

ADULT (Fig. 16). Fore wing length: ♂, 14–17 mm, ♀, 15–17 mm.

Front of head mid to dark brown, usually with dark green upper edge, 2 white marks, almost merged, in lower corners. Without white interantennal fillet other than at most a few white scales (although specimens in French Guiana may have a cream fillet); dorsal area of head green, sometimes mixed with white. Antennae with weak white dorsal line along basal half of flagellum. Wing pattern: brown speckles and strongly-waved broken lines; with short band between M2 and M3 of fore wing, parallel to these veins. Hind wing with veins M3 and CuA1 on very short common stalk, rarely meeting. Front of fore tibia: lower three-quarters dark brown, upper part white; oblique white bar usually broken in middle. Abdomen with mottled brown dorsal markings at least at anterior end or at sides, and often an elongate patch towards posterior end; anterior marking commonly mottled with white.

GENITALIA ♂ (Figs 103, 162, 230). Uncus spatulate and fairly short; socii slightly tapered but not pointed. Basal costal process of valva slightly coiled, tapered; slightly more than half length of valva; costal margin of valva slightly swollen at free end and with slight to distinct pointed projection at about two-thirds. Coremata differenti-

ated into two types; long sac conspicuous. Sternite 8 with deep posterior notch.

GENITALIA ♀ (Figs 275, 296, 336). Shallow pouch joining ostium and sternite 7 broad. Corpus bursae oval.

DIAGNOSIS. The speckles and blotches of the wings (Fig. 16) are more distinct than those of *aturia aturia* (Fig. 14) and more scattered than in the smaller moth *hazela* (Fig. 19). The wing pattern of *scriptaria* is similar to that of *nigricincta* (see catalogue of extralimital species) but that species, unlike *scriptaria*, has a distinctly white interantennal fillet.

VARIATION. Moths at the southern and eastern ends of the range tend to be more strongly marked and the Brazilian version was described as a distinct species, *radiolinea*. The costal projection of the male valva is strongest in the Costa Rican specimen that was dissected.

REMARKS. Fletcher (1979: 114) drew attention to the resemblance between *scriptaria*, known only from Stoll's illustration, and *exertata*. Prout (1932: 35) referred to *radiolinea* as possibly a form of *exertata*.

BIOLOGICAL NOTES. Moths have been found at altitudes of 0–700 m in Costa Rica (to 1300 m in Bolivia), in January, March to November (in Costa Rica).

DISTRIBUTION. From Costa Rica to Brazil, French Guiana and Bolivia.

MATERIAL EXAMINED (146 specimens, including 3 ♂, 1 ♀ genitalia preparations)

Holotype ♂ (*exertata*), **Surinam** (MNHU). Holotype ♂ (*radiolinea*), **Brazil**: Amazonas ('Upp. Amazons'), Fonte Boa, vi.1906 (*Klages*) (genitalia slide Geom. 16173; BMNH).

Costa Rica: *Alajuela Province*: 2 km SW. of Dos Ríos, Finca San Gabriel, 600 m (UTM 318800,383500, W85° 23'50", N10° 53'19"), 630 m, 650 m; 7–9 km S. of Santa Cecilia, Estacion Pitilla, 500 m (W85° 25'33", N11° 00'18"), 700 m; *Guanacaste Province*: Rincon National Park, 4 km E. of Casetilla; *Heredia Province*: Puerto Viejo de Sarapiquí, Finca La Selva (OTS), 40 m, 50 m; [*Limón Province*]: Banano River; (INBio and BMNH). 9.4 km W. of Bribri, Suretka, 200 m; Florida, c 150 m; Limón; Sixaola River; N. edge Tortuguero National Park, Cerro Tortuguero, 100 m, UTM 285000,588000; Tortuguero National Park, Quatro Esquinas, 0 m, UTM 280000,590500; *Puntarenas Province*: Manuel Antonio National Park, Quepos, UTM 370300,448100; Osa Peninsula, Corcovado

National Park, Sirena, 0–100 m, UTM 270500,508300; 35 km S. of Palmar Norte, Fila Esquinas, 150 m, 8° 45' x 83° 20'; Carara Biological Reserve, Estacion Quebrada Bonita, 50 m, UTM 194500,469850; *San José Province*: Braulio Carrillo National Park, Estacion Carrillo, 700 m. **Panama**: Chiriquí (BMNH). **French Guiana**: St Jean du Maroni; St Laurent du Maroni; (BMNH). **Colombia**: Muzo, 400–800 m; Upper ('Ob.') Río Negro, 800 m; (BMNH). **Peru**: [Loreto,] Yahuas Territory; Río Inambari, La Oroya, c. 900 m (3000 ft). **Bolivia**: [Cochabamba,] Charapaya 'Charaplaya', 1300 m; [Santa Cruz,] Buenavista. **Brazil**: *Amazonas*: Fonte Boa, Santo Antônio de Javari; Sao Paulo de Olivença; [*Rondônia*]: Rio Madeira, below Santo Antônio, Aliança.

The *strigaria*-group

ADULT. Medium-sized for the genus. Front of head brown; often without white interantennal fillet. Male with length of longest antennal branches up to or exceeding three times width of flagellum at same point; flagellum slender. Wing pattern: without white antemedial and postmedial lines and reddish brown terminal line. Even fresh specimens tend to have a delicate appearance with somewhat translucent wings. Hind wing with veins M3 and CuA1 separate.

GENITALIA ♂ (Figs 104, 105, 139, 163–165, 231, 232). Socii tapered to a point. Valva narrow; costal margin curved, usually with small tongue-like distal process; basal costal process usually blade-like; about half length of valva to slightly longer than valva. Juxta without papilla. Coremata usually weakly developed. Saccus notched.

DISTRIBUTION. The *strigaria*-group comprises two species, known only from high elevations, mainly in lower montane to montane rain forest or in montane wet forest, in central Costa Rica.

Nemoria saryae sp. n.

(Figs 24, 104, 163, 231)

ADULT (Fig. 24). Front of head mottled light to mid dull brown, 2 off white marks in lower corners; without interantennal fillet; dorsal area of head green; antennae with traces of dotted white dorsal line along basal half of flagellum. Wing pattern: speckled with diffuse brown patches forming indistinct fasciae; outer margins with a row of dark brown dots. Discal spot of fore wing slightly more conspicuous than small spot of hind wing. Front of fore tibia fawn

without white bar. Abdomen with 1–3 small dark brown dorsal spots.

GENITALIA ♂ (Figs 104, 163, 231). Basal costal process of valva a broad blade with pointed finely serrated tip, extending towards tip of valva; bent strongly near but not at base; costal margin of valva curved, with tongue-like distal process. Coremata not seen. Sternite 8 sometimes with only a slight posterior notch; tergite 8 with shallow excision.

♀. Unknown.

DIAGNOSIS. *N. saryae* is distinguished by its delicate wing pattern of indistinct brown fasciae (Fig. 24). The basal costal process of the male valva (Fig. 163) is unique in form.

REMARKS. This species is named in honour of Sary Rojas Leiva, member of the first female parataxonomist class at INBio.

BIOLOGICAL NOTES. Moths have been found at an altitude of 2350 m, in July and December.

DISTRIBUTION. Known only from one locality in central Costa Rica.

MATERIAL EXAMINED (6 ♂, including 2 genitalia preparations)

Holotype ♂, **Costa Rica:** Alajuela Province, Volcán Poás, 2350 m, 12.vii.1982 (Janzen & Hallwachs) (INBio).

Paratypes. **Costa Rica:** 5 ♂, same locality as holotype, 12.vii.1982, 15.xii.1982 (Janzen & Hallwachs) (INBio and BMNH).

Nemoria strigaria (Schaus) **comb. n.**

(Figs 25–27, 105, 139, 164, 165, 232, 297, 337)

Racheospila strigaria Schaus, 1912: 290. **LECTO-TYPE** ♀, **COSTA RICA** (USNM), here designated [examined].

ADULT (Figs 25–27). Front of head tan or reddish brown, 2 whitish marks, usually merged, in lower corners. Interantennal fillet sometimes mottled or overlaid with green or absent (always absent in blotched and speckled forms); area behind fillet broad green. Antennae with white dorsal line along basal half of flagellum (typical form) or with weak dotted line (other forms). Wing pattern: typical form striated with white and with bluish tinge to green colour of wings and body; discal spots occasionally absent. Speckled form: wings faintly speckled with scattered dark brown scales and outer margins with a row of dark brown dots. Blotched form: with very large discal spots and two small dark brown

blotches at costa towards apex. Front of fore tibia slender, dark or rose brown mottled with fawn; white bar usually reduced to a spot or absent. Abdomen without dorsal spots in typical form but with 3 small blackish brown spots in the other two forms.

GENITALIA ♂ (Figs 105, 139, 164, 165, 232). Socii triangular, pointed at apices. Basal costal process of valva a tapered blade or occasionally rod-like, usually with kink or bend near base, about half length of valva to slightly longer than valva; costal margin of valva slightly or well curved, usually with small tongue-like distal process. Coremata weakly developed except in blotched form (only one specimen of that form examined); coremata sac never long. Sternite 8 at most slightly notched between posterior lobes.

GENITALIA ♀ (Figs 297, 337). Apophyses anteriores half, or less than, half length of apophyses posteriores. Pouch joining ostium and sternite 7 extremely shallow, crescent-shaped or linear; ostium surrounded by irregularly concentric rings of wrinkles. Ductus bursae much shorter than segment 7.

DIAGNOSIS. The typical form of *strigaria* is distinguished by the pale striations of its wings (Fig. 27); such markings are not uncommon in nearctic *Nemoria* species but are rare in Neotropical species. The similar *duniae* has a green front of head, unlike *strigaria*, and other striated species, *dorsilinea* and *vermiculata*, have distinct postmedial lines. The blotched form of *strigaria* is also easily recognised by its wing markings (Fig. 25). The speckled form (Fig. 26) is less distinctive but the absence of a white interantennal fillet separates it from other lightly speckled species, except the closely related *saryae* (Fig. 24) which has more brown markings on its wings. The basal processes of the male valva differ in all these species.

VARIATION. The three forms of wing pattern exist sympatrically and are treated here as conspecific although their relationship is uncertain. The male valva also varies considerably, as much within the typical form (Figs 164, 165) as between the three forms (see Fig. 139 of the blotched form). This variation is seen in the length and shape of the basal process and the degree of development of the distal process.

BIOLOGICAL NOTES. Moths have been found at altitudes of 2350–3100 m, in March to May, July, August and December.

DISTRIBUTION. Known only from central Costa Rica.

MATERIAL EXAMINED. Typical form (11 specimens, including 5 ♂, 3 ♀ genitalia preparations)

Lectotype ♀, **Costa Rica:** [Cartago Province,] Vol[can] Turrialba, viii (genitalia slide no. 57,582; Type No. 17728; USNM).

Costa Rica: *Alajuela Province:* Volcán Poás, 2350 m; *Cartago Province:* Cerro [de] la Muerte, 3100 m; Cerro de la Muerte, 1 km NE. of Cerro Asuncion, 3100 m; Cerro de [la] Muerte, Pension La Georgina, 3000 m (UCB); *San José Province:* Cerro de la Muerte, San Gerardo de Dota, 2430 m; (INBio and BMNH unless stated otherwise).

Blotched form (3 ♂, including 1 genitalia preparation)

Costa Rica: *Alajuela Province:* Volcán Poás, 2350 m (INBio and BMNH); *Cartago Province* (S. border): Cerro de [la] Muerte, Pension La Georgina, 3000 m (UCB).

Speckled form (4 ♂, including 1 genitalia preparation)

Costa Rica: *Alajuela Province:* Volcán Poás, 2350 m; *Heredia Province:* Braulio Carrillo National Park, Estacion Barva, 2500 m (INBio and BMNH).

The *gladysae*-group

ADULT. Medium-sized for the genus. Front of head and area behind white interantennal fillet green. Wing pattern plain with waved white antemedial and postmedial lines. Hind wing with veins M3 and CuA1 on short common stalk. Abdomen with 3 or more white dorsal spots, anterior spot and sometimes other main spots ringed with reddish brown.

GENITALIA ♂ (Figs 106, 107, 166, 167, 233, 234). Valva narrow and long, extending beyond tips of socii, with blade-like process at extreme tip rather than subapically; basal costal process very short. Juxta with papilla. Hair-like coremata well developed on long sac. Saccus notched. Anellar plate short. Aedeagus slender with a row of small spines on one or both sides.

♀. Unknown.

DISTRIBUTION. The *gladysae*-group comprises two species, known only from Costa Rica.

Nemoria franciscae sp. n.

(Figs 63, 106, 166, 233)

ADULT (Fig. 63). Interantennal fillet with nar-

row orange-tan band at front edge and a few scattered orange-tan scales at hind edge. Front of fore tibia pale brown. Abdomen with 3 white dorsal spots, anterior spot ringed with tan; plus 3 white traces: 1 between anterior and middle spots, other 2 towards posterior end.

GENITALIA ♂ (Figs 106, 166, 233). Uncus with narrow tip. Valva extending well beyond tips of socii; basal costal process blunt; costal margin of valva straight, forming pointed process at tip. Aedeagus tapered, with a row of small spines on each side.

♀. Unknown.

DIAGNOSIS. The narrow tan band at the front edge of the interantennal fillet is a diagnostic feature and the pointed tip of the long male valva (Fig. 166) can be seen without dissection.

REMARKS. This species is named in honour of Katty Francisca Flores Herrera, member of the first female parataxonomist class at INBio.

BIOLOGICAL NOTES. Moths were found at an altitude of 100 m, in November.

DISTRIBUTION. Known only from one locality in tropical wet forest in north-eastern (Atlantic) Costa Rica.

MATERIAL EXAMINED (2 ♂, including 1 genitalia preparation)

Holotype ♂, **Costa Rica:** Limón Province, Tortuguero National Park, Cerro Tortuguero, 100 m, UTM 285000,588000, xi.1989 (*Solano*) (genitalia slide no. LMP 268; INBio).

Excluded from type-series. 1 ♂ (without abdomen), locality as holotype (BMNH).

Nemoria gladysae sp. n.

(Figs 62, 107, 167, 234)

ADULT (Fig. 62). Hind edge of interantennal fillet often with a few scattered orange-tan scales. Front of fore tibia golden brown; oblique white bar sometimes indistinct. Abdomen with 3 white dorsal spots weakly ringed with reddish brown.

GENITALIA ♂ (Figs 107, 167, 234). Basal costal process of valva rounded; costal margin of valva curved, forming rounded, very finely serrated process at tip which resembles shallow scoop. Juxta with broad papilla. Aedeagus linear with a band of two or more rows of small spines. Tergite 8 with shallow notch.

♀. Unknown.

DIAGNOSIS. *N. gladysae* is not easy to recognise

on external features; species-group characters narrow the field but are shared by several species outside the group. The tip of the long male valva (Fig. 167) is characteristic though, and can be seen without dissection. The incomplete tan band at the hind edge of the interantennal fillet distinguishes *gladysae* from the externally similar *venezuelae*, and the lack of a tan band at the front edge separates it from *franciscoe*.

REMARKS. This species is named in honour of Gladys Rodríguez Ramírez, member of the first female parataxonomist class at INBio.

BIOLOGICAL NOTES. Moths have been found at altitudes of 650–700 m, in March, May, July to September, November.

DISTRIBUTION. Known from northwestern (Pacific) to central Costa Rica.

MATERIAL EXAMINED (6 ♂, including 2 genitalia preparations)

Holotype ♂, **Costa Rica**: Alajuela Province, 1 ♂, 16 km of ENE. Quebrada Grande, Finca San Gabriel, 650 m, 11.xi.1983 (genitalia slide no. LMP 256; INBio).

Paratypes. **Costa Rica**: *Alajuela Province*: 1 ♂, 9 km S. of Santa Cecilia, Estacion Pitilla, 700 m, vii.1988 (*Espinosa and Chaves*); *San José Province*: 4 ♂, Braulio Carrillo National Park, Estacion Carrillo, 700 m, viii, ix.1984, iii, v.1985, vii.1988 (*I. & A. Chacon*). (INBio and BMNH.)

The *cosmeta*-group

ADULT. Medium-sized for the genus. Front of head tan or reddish brown with 4 white or cream marks; white interantennal fillet present. Wing pattern plain with fairly smooth white antemedial and postmedial lines; brown discal spots sometimes absent or extremely faint. Hind wing with veins M3 and CuA1 on short common stalk. Front of fore tibia straw to reddish brown; oblique white bar sometimes indistinct.

GENITALIA ♂ (Figs 108–111, 168–172, 235–239). Basal costal process of valva rod-like and spinulose, of similar length to valva or longer. Juxta with papilla. Coremata weakly developed (except in *cosmeta* and *marielosae*). Saccus notched. Aedeagus often with medial process or other modification.

GENITALIA ♀ (Figs 298–301). Pouch joining ostium and sternite 7 bisected by notch in sternite.

DISTRIBUTION. From nearctic Mexico to Brazil and Bolivia.

The *cosmeta*-group comprises seven species, four of which occur in Costa Rica; *sarukhani*, known only from Nearctic Mexico, is described here because it is closely related to *lorenae* and *marielosae*. (See the catalogue of extralimital species for the other two species.)

Nemoria cosmeta (Prout)

(Figs 32, 168, 235, 298)

Miantonota decorata Warren, 1904a: 22. Holotype ♂, MEXICO (BMNH) [examined]. [Junior homonym of *Racheospila decorata* Warren, 1901: 449.]

Racheospila cosmeta Prout, 1912: 106. [Replacement name.]

Nemoria cosmeta (Prout); Ferguson, 1969: 79.

ADULT (Fig. 32). Area behind interantennal fillet tan; hind edge of head green. Wing with smooth or slightly waved antemedial and postmedial lines; hind postmedial distinctly bent; brown discal spot extremely small on fore wing, just discernible or replaced by minute green dot on hind wing. Abdomen (based on one specimen examined) with 3 white or cream, tan-mottled dorsal spots plus one diffuse spot between anterior and middle spots and one trace towards posterior end, ringed with reddish brown; abdomen predominantly tan with trace of green at sides.

GENITALIA ♂ (Figs 168, 235). Basal costal process of valva slender with blunt spinulose free end, longer than valva; valva more or less parallel-sided, without distal process. Hair-like coremata well developed.

GENITALIA ♀ (Fig. 298). Apophyses anteriores half or slightly less than half length of apophyses posteriores. Pouch joining ostium and sternite 7 large and semicircular, bisected by deep notch in sternite; ostial region finely wrinkled and ostium surrounded by concentric rings of wrinkles. Ductus bursae with some light sclerotization particularly towards ostial end; extending to anterior edge of segment 7.

DIAGNOSIS. *N. cosmeta* is very similar to *marielosae* and cannot be reliably distinguished on external characters; it is also similar to *lorenae* although that species has a more weakly bent postmedial line of the hind wing. There are distinct genitalic differences: males of all three species have a long basal process of the valva, the tip of which can be seen without dissection. This is slender in *cosmeta* (Fig. 168) and *lorenae* (Fig. 170) and swollen in *marielosae* (Fig. 171); also,

the valva lacks a distal process in *cosmeta* whereas the other two species have distal processes. The females differ in the form and wrinkling of the ostial region. It is not certain that the three females here assigned to *cosmeta*, from Costa Rica, are conspecific with the male holotype from Mexico.

BIOLOGICAL NOTES. Moths have been found at an altitude of 1200 m.

DISTRIBUTION. Neotropical Mexico and Costa Rica.

MATERIAL EXAMINED (1 ♂, 3 ♀; including 1 ♂, 3 ♀ genitalia preparations)

Holotype ♂, **Mexico:** Veracruz, Huatusco (genitalia slide Geom. 5698; BMNH).

Costa Rica: [Cartago Province:] Juan Vinas (USNM); Orosi, 1200 m (BMNH).

Nemoria karlae sp. n.

(Figs 34, 74, 108, 169, 236, 299)

ADULT (Fig. 34). Front of head brown, usually reddish and sometimes fairly dark; occasionally (Costa Rica) or usually (Guatemala and Mexico) with green central area; area behind interantennal fillet green. Wings with fairly smooth antemedial and postmedial lines, postmedial of hind wing distinctly bent; brown discal spots sometimes tiny, particularly on hind wing. Abdomen (Fig. 74) with 2 dark brown dorsal spots: posterior spot larger or (occasionally) divided into two.

GENITALIA ♂ (Figs 108, 169, 236). Basal costal process of valva slender, slightly tapered, with bend or kink near base; much longer than valva. Distal process of valva a pointed, sometimes very small, lobe. Corematal sac sometimes long but with weak development of hair-like tufts. Wall of aedeagus with twisted rugosely marked mid region.

GENITALIA ♀ (Fig. 299). Apophyses anteriores half length of apophyses posteriores. Pouch joining ostium and sternite 7 large and crescent-shaped or semicircular, bisected by deep notch dividing sternite; ostium flanked by pair of rugosely sclerotized tadpole-shaped structures with jagged ridges. Ductus bursae slightly sclerotized towards ostium; shorter than segment 7. Signum with straight line at opening.

DIAGNOSIS. *N. karlae* differs from other Costa Rican species of the *cosmeta*-group in having dark brown spots on the abdomen. It bears a close superficial resemblance to *rectilinea* (not in

this group) but differs in the relative size of the abdominal spots: the posterior spot is larger in *karlae* (Fig. 74) whereas the anterior spot is larger in *rectilinea* (Fig. 75). The genitalia of both sexes have distinctive features which can be seen without dissection: the long basal process of the male valva (Fig. 169) and the unique pair of structures flanking the female ostium (Fig. 299). The twisted aedeagus separates *karlae* from the closely related *imitans* and *integra*. All these species are allopatric.

REMARKS. This species is named in honour of Karla Eloisa Taylor Martínez, member of the first female parataxonomist class at INBio.

BIOLOGICAL NOTES. Moths have been found at altitudes of 40–1460 m in Costa Rica (up to 1520 m in Mexico), throughout the year (in Costa Rica).

DISTRIBUTION. Neotropical Mexico to Panama.

MATERIAL EXAMINED (79 specimens; including 5 ♂, 3 ♀ genitalia preparations)

Holotype ♂, **Costa Rica:** [Cartago Province,] Sitio, v (genitalia slide Geom. 13318; BMNH).

Paratypes. **Mexico:** 1 ♂, 1 ♀, Queretaro, 32 km SW. of Xilitla, 1520 m, 24–25.vi.1982 (*Rawlins*) (CMNH); 1 ♀, Córdoba ('Cordova'), v (USNM); 3 ♀, Tamaulipas, 6 km NNW. Gomez Farias, Rancho del Cielo, c. 1100 m, vii.1982 (*Solis*) (USNM); **Veracruz:** 6 ♂, Estac. Biol. Las Tuxtlas, 1–9.vii.1988 (*Chemsak*) (UCB); 3 ♂, Río Metlec, Fortín de las Flores, 15.viii.1987 (*Brown*) (UCB); Motzorongo ('Muzarongo'), xi (USNM). **Guatemala:** 1 ♂, 1 ♀, [Izabal,] Cayuga, iv, viii (USNM); **El Salvador:** 1 ♂, San Salvador (USNM); **Costa Rica:** *Alajuela Province:* 1 ♂, 1 ♀, 5 km N. of Col. Palmarena, San Ramón Forest Reserve, 900 m, 11.v.1985 (*I. & A. Chacon*); 1 ♀, 5 km NW. of Dos Ríos, Finca Campana, 750 m, 21.iii.1985 (*Janzen & Hallwachs*); 10 ♂, 6 ♀, 2 km SW. of Dos Ríos, Finca San Gabriel, 600 m (UTM 318800,383500), 630 m, 650 m, ii, iii, v, xi.1983, v.1984, vi.1988, v.1989, vii, viii.1990 (*GNP Biodiversity Survey; Janzen & Hallwachs; Pitkin*); 1 ♂, E. slope of Volcán Cacao, Cerro Compañía, 650 m, 15.vi.1988 (*Brown & Powell*) (UCB); 3 ♂, N. slope of Volcán Poás, 8 km N of Vara Blanca, 1300 m, 1400 m, 6.vi.1988, 25.vii.1990 (*Brown; Powell*) (UCB); [Cartago Province:] 3 ♂, 1 ♀, Juan Viñas, xi–ii (BMNH, CMNH and USNM); 2 ♂, 2 km E. of Moravia de Chirripo, 1150 m, 09° 50'N, 83° 24'W, 9.i.1984 (*Rawlins & Thompson*) (CMNH); 1 ♀, Orosi, 1200 m (*Fassl*); 7 ♂, Río Grande de Orosi, Tapanti, 1300–1400 m, 9°

46'x 83° 50', 17.xi.1982, 9.iv.1984 (Janzen & Hallwachs); 2 ♀, Tuis [including 1, c. 750 m], vi.1907, 28.v–4.vi (USNM); 1 ♀, 3 km SE. of Turrialba, CATIE, 600 m, 13.v.1985 (Chemsak, Opler & Powell) (UCB); *Guanacaste Province*: 3 ♂, Rincon National Park, 4 km E. of Casetilla, 750 m, 14.viii.1981, 18.x.1982, 16.vi.1983 (Janzen & Hallwachs); *Heredia Province*: 4 ♂, 2 ♀, Puerto Viejo de Sarapiquí, Finca La Selva, 40 m, 50 m, UTM 268800,535300, 4.viii.1981, iii.1985, xi.1986, ii, x, xii.1987 (Chavarría; Janzen & Hallwachs); *Limón Province*: 1 ♂, 9.4 km W. of Bribri, Suretka, 200 m, 9–11.vi.1983 (Janzen & Hallwachs); *Puntarenas Province*: 2 ♂, 1 ♀, Monteverde, c. 1250 m, 1350 m, 8.viii.1986, 3.ix.1988 (Covell) (CVCJ); 1 ♂, 2 km E. of Monteverde, 1460 m, 12.vi.1988 (Brown & Powell) (UCB); 3 ♂, 1 ♀, San Vito, Las Cruces Biol. Station, 1200 m, 16–20.xi.1987, 13–18.v.1988 (I. Chacon); *San José Province*: 1 ♂, Braulio Carrillo National Park, La Montura, 1100 m, 17.xii.1981 (Janzen & Hallwachs); (INBio and BMNH unless stated otherwise). **Panama**: 1 ♂, Río Trinidad, iii (USNM).

Nemoria lorenae sp. n.

(Figs 30, 109, 170, 237, 300)

ADULT (Fig. 30). Interantennal fillet with reddish brown band at hind edge; hind edge of head green. Wings with smooth antemedial and postmedial lines; hind postmedial only slightly bent; brown discal spots absent, replaced by minute faint green dot on fore wing. Hind wing with veins M3 and CuA1 sharing a very short common stalk. Abdomen with 3 white or cream dorsal spots plus up to 3 white traces in tan patch at posterior end, anterior spot at least partly cream; all spots ringed with reddish brown.

GENITALIA ♂ (Figs 109, 170, 237). Socii nearly as long as uncus. Basal costal process of valva slender, slightly or distinctly longer than valva; basal half fused with valva. Distal process of valva a simple extension of costal sclerotization. Juxta with broad papilla. Aedeagus with spinose finger-like medial process.

GENITALIA ♀ (Fig. 300). Apophyses anteriores about half length of apophyses posteriores. Pouch joining ostium and sternite 7 semicircular or crescent-shaped, bisected by notch and deep fold in sternite; ostial region deeply wrinkled. Sternite 7 more sclerotized than normal in *Nemoria*. Ductus bursae extending to anterior edge of segment 7. Signum with almost straight line at opening.

DIAGNOSIS. *N. lorenae* is very similar to *marielosae* but can be distinguished from this by the slightly bent postmedial line of hind wing (compare Figs 30 and 29). The tip of the basal process of the male valva can be seen without dissection and is slender in *lorenae* (Fig. 170) and swollen in *marielosae* (Fig. 171). The distal processes of the two species differ from each other and from others in the *cosmeta*-group. The female ostial region is more strongly wrinkled in *lorenae* (Fig. 300) than in *marielosae* (Fig. 301) or *cosmeta* (Fig. 298).

REMARKS. This species is named in honour of Katty Lorena Martínez Sequeira, member of the first female parataxonomist class at INBio.

BIOLOGICAL NOTES. Moths have been found at an altitude of 300 m, in May and November to January (in Costa Rica).

DISTRIBUTION. Guatemala and northwestern (Pacific) Costa Rica.

MATERIAL EXAMINED (4 ♂, 4 ♀; including 2 ♂, 2 ♀ genitalia preparations)

Holotype ♂, **Costa Rica**: Guanacaste Province, Santa Rosa National Park, 12–14.v.1980 (Janzen & Hallwachs) (genitalia slide no. LMP 257; INBio).

Paratypes. **Guatemala**: 1 ♂ (Rodríguez) (BMNH). **Costa Rica**: *Guanacaste Province*: 2 ♀, 12 km SE. of La Cruz, Casa Oeste, Cerro El Hacha, 300 m, xi.1987, i.1988 (A. Chacon); 2 ♂, 2 ♀, Santa Rosa National Park, v.1980, xii.1982 (Janzen & Hallwachs); (BMNH and INBio).

Nemoria marielosae sp. n.

(Figs 29, 110, 171, 238, 301)

ADULT (Fig. 29). Band at hind edge of interantennal fillet usually narrow, orange or reddish brown; with green area behind. Wings with smooth antemedial and postmedial lines; hind postmedial distinctly bent; brown discal spots absent or occasionally a just discernible trace on fore wing, sometimes replaced by tiny green dot on fore wing. Hind wing with veins M3 and CuA1 on short, occasionally extremely short, common stalk. Abdomen with 3 dorsal spots ringed with reddish brown: anterior spot cream, others cream-tinged white; plus tan patch at posterior end usually containing 1–3 whitish traces.

GENITALIA ♂ (Figs 110, 171, 238). Socii sometimes moderately long though considerably shorter than uncus. Basal costal process of valva a thick spatulate rod (resembling a golf club), of

similar length to valva, basal half fused with valva. Distal process of valva with flat plate set more or less at right angles to costal sclerotization. Well developed hair-like coremata on long sac. Aedeagus with spinose finger-like medial process. Sternite 8 with narrow slit-like posterior notch.

GENITALIA ♀ (Fig. 301). Apophyses anteriores slightly more than half length of apophyses posteriores. Pouch joining ostium and sternite 7 semicircular, bisected by deep notch in sternite; ostial region finely wrinkled, ostium flanked by pair of sclerotized lobes which are much smaller than pouch. Ductus bursae extending to anterior edge of segment 7. Signum with straight line at opening.

DIAGNOSIS. In males of *marielosae* the swollen tip of the basal process (Fig. 171) can be seen without dissection and is a unique feature. The structure of the female ostial region (Fig. 301) is also characteristic. (See diagnoses of *lorenae* and *cosmeta* for other differences between these species.)

VARIATION. The basal costal process of the male varies considerably in thickness and in the degree of swelling of the tip.

REMARKS. This species is named in honour of Marielos Enríquez, member of the first female parataxonomist class at INBio.

BIOLOGICAL NOTES. Moths have been found at altitudes of 100 – c. 1250 m, throughout the year except in September (in Costa Rica).

DISTRIBUTION. Neotropical Mexico and Costa Rica.

MATERIAL EXAMINED (107 specimens; including 7 ♂, 3 ♀ genitalia preparations)

Holotype ♂, Costa Rica: Guanacaste Province, Santa Rosa National Park, 12–14.v.1980 (Janzen & Hallwachs) (genitalia slide no. LMP 258) (INBio).

Paratypes. Mexico: 5 ♂, 1 ♀, Jalisco, Estacion Biologia Chamela, x.1986, x.1987, xi–xii.1988 (Chemsak & Powell) (UCB); 1 ♀, Orizaba, xi.1909 (Müller) (BMNH); 1 ♂, Zacualpan, xii.1922 (Muller) (USNM). **Costa Rica:** Alajuela Province: 1 ♂, 2 km SW. of Dos Ríos, Finca San Gabriel, 600 m, UTM 318800,3835000, v.1989 (GNP Biodiversity Survey); 2 ♂, 1 ♀, 8–9 km S. of Santa Cecilia, Estacion Pitilla, 680 m, 700 m, v, vii.1988 (Janzen & Hallwachs; Scoble & Brooks); Guanacaste Province: 2 ♂, 3 ♀, 12 km SE. of La Cruz, Casa Oeste, Cerro El Hacha, 300 m, UTM 320000,364000, x–xii.1987 (A. Cha-

con); 28 ♂, 2 ♀, 31 km N. of Liberia, Fca Jenny, 300 m, W85° 34'27", N10° 51'55", xi.1987, vii, viii, xi, xii.1988 (GNP Biodiversity Survey); 37 ♂, 15 ♀, Santa Rosa National Park, vi.1978, i, v–viii, xi.1979, v, vi.1980, iii.1982, iii–vi, xii.1983 (Janzen & Hallwachs); 2 ♀, locality as before, HQ area, 280 m, vi.1988 (Brown & Powell) (UCB); 1 ♀, 6.7 km N. of Quebrada Grande, Hcda. San Isidro, 350 m; 1 ♀, 4 km W. of Santa Cecilia, 250 m, 25.ii.1985 (Janzen & Hallwachs); Heredia Province: 1 ♂, Chilamate, 100 m, 9.viii.1986 (Covell) (CVCJ); Puntarenas Province: 1 ♀, Monteverde, c. 1250 m, 8.viii.1986 (Covell) (CVCJ); 1 ♂, no further data (Underwood); (BMNH and INBio unless stated otherwise).

Nemoria sarukhani sp. n.

(Figs 31, 111, 172, 239)

ADULT (Fig. 31). Known from just a single male specimen. Area behind interantennal fillet green. Wings with smooth antemedial and post-medial lines; hind postmedial distinctly bent; brown discal spots minute and extremely faint, particularly on hind wing. Abdomen with 4 white or whitish dorsal spots, 2 middle spots faintly ringed with tan brown; posterior spot smaller.

GENITALIA ♂ (Figs 111, 172, 239). Basal costal process of valva slender, longer than valva, strongly bent near base giving rise to short, markedly spinulose process; distal process of valva triangular. Juxta with slight papilla. Aedeagus with smooth slender spine-like medial process. Sternite 8 with slight posterior notch.

♀. Unknown.

DIAGNOSIS. The unique specimen of *sarukhani* is slightly faded but it is very similar to *marielosae* and *lorenae*, though, unlike those two species, it is known only from Nearctic Mexico. The basal process of the male valva (Fig. 172) and the spine-like process of the aedeagus (Fig. 239) are highly distinctive.

REMARKS. This species is named for Dr José Sarukhán, the Rector of UNAM, the Universidad Nacional Autónoma de México, to honour his enormous contribution to the conservation of the biodiversity of Mexico through stimulating the formation of the Mexican Comisión Nacional para el Conocimiento y Uso de la Biodiversidad.

DISTRIBUTION. The only specimen was collected in Nearctic Mexico at an altitude of c. 1250 m, in August.

MATERIAL EXAMINED (1 ♂, including genitalia preparation)

Holotype ♂, **Mexico**: Sinaloa, 2 km S. Santa Lucia, Villa Blanca, c. 1250 m ('4000 ft'), 12.viii.1986 (Brown & Powell) (genitalia slide no. LMP 201; CAL).

The *pacificaria*-group

ADULT. Medium-sized for the genus. Front of head and area behind white interantennal fillet green. Wing pattern plain with waved white antemedial and postmedial lines. Hind wing with veins M3 and CuA1 on short common stalk (occasionally extremely short in *pacificaria*). Abdomen with 2 dark brown dorsal spots: posterior spot on segment 4, extending onto segment 3; anterior spot on segment 1, not extending onto segment 2.

GENITALIA ♂ (Figs 112, 113, 173–178, 240, 241). Valva with small spinose process, and slight tuft of hairs, at free end. Basal costal process of valva consisting of small lobe adjoining slightly more posterior rod-like process; two-thirds length of valva or as long as valva; rod-like process fused with costa for short length from base. Juxta with papilla. Hair-like coremata well developed on long sac. Saccus notched.

GENITALIA ♀ (Figs 302–307). Apophyses anteriores half or usually more than half length of apophyses posteriores. Pouch joining ostium and sternite 7 irregularly crescent-shaped.

REMARKS. Members of the *pacificaria*-group resemble *carolinae* but in that species the spots are positioned differently on the abdomen (compare Figs 76 and 77).

DISTRIBUTION. The *pacificaria*-group, comprising two species, is found from Neotropical Mexico to South America, where its range extends westwards to French Guiana, and southwards to Ecuador and Brazil.

Nemoria pacificaria (Möschler) comb. n.

(Figs 36, 76, 112, 173–175, 240, 302–304)

Racheospila pacificaria Möschler, 1881: 403.

Holotype ♀, SURINAM (MNHU) [examined].

ADULT (Fig. 36). Front of fore tibia straw sometimes mixed with brown; oblique white bar sometimes indistinct. Dorsal spots of abdomen (Fig. 76): oval or round posterior spot, large or occasionally divided into 2; anterior spot sometimes also large.

GENITALIA ♂ (Figs 112, 173–175, 240). Rod-like basal costal process of valva very slender and slightly sinuous. Valva with small process at free end, consisting of a few tiny spines and a slight tuft of 'hair', at tip of midrib; midrib divided into two distal branches. Papilla of juxta sometimes long.

GENITALIA ♀ (Figs 302–304). Sternite 7 with pair of large, somewhat sclerotized patches surrounded (incompletely) by one to four thick ridges. Ductus bursae shorter than segment 7.

DIAGNOSIS. *N. pacificaria* is near *tutala* and can be reliably distinguished only by dissection; even then the differences are subtle and complicated by variation. The status of the two species and their various geographic forms needs further clarification. The two species appear to have allopatric distributions within Costa Rica but overlap in South America. In males the main difference between *pacificaria* and *tutala* is in the midrib of the male valva, which divides into two distal branches in *pacificaria* (Figs 173–175) but not in *tutala* (Figs 176–178). The female of *pacificaria* has a few strong ridges on sternite 7 (Figs 302–304) whereas *tutala* usually has finer or more numerous ridges (Figs 305–307).

VARIATION. The genitalia of both sexes show geographic variation and two forms are recognised here: the typical form and the northern form (see distribution below), though occasional specimens are intermediate. In males of the northern form the costal margin of the male valva is finely serrated at its free end and the costal surface in this area usually slightly rugose or pitted (Figs 174, 175). This area is smooth in the typical form (Fig. 173). In some specimens of the northern form (mainly the population in Santa Rosa National Park, Fig. 174) the small cluster of tiny spines projects slightly beyond the free end of the valva whereas this cluster does not project and is thus less obvious in other specimens of the northern form. Within both forms individual variation is seen in the length and shape of the basal process of the male valva (Figs 173–175).

In females of the typical form (Fig. 302) some of the ridges on sternite 7 are almost longitudinal (in relation to the abdomen) and the sclerotized patches are well separated whereas in the northern form (Figs 303, 304) these ridges are diagonal and the sclerotized patches are closer together. As in the males, the northern form is variable and the Santa Rosa population has fewer ridges and the patches are further apart than in most other specimens of the northern form.

BIOLOGICAL NOTES. Moths have been found at altitudes of 50m (typical form), 100–700 m (northern form); in January, March to August, November and December (in Costa Rica).

DISTRIBUTION. Typical form: from Costa Rica (Pacific side: west-central to south) to French Guiana. Northern form: from Neotropical Mexico to northwestern (Pacific) Costa Rica. Form unidentified: Trinidad.

MATERIAL EXAMINED. Typical form (10 specimens, including 5 ♂, 3 ♀ genitalia preparations)

Holotype ♀, **Surinam:** Paramaribo (genitalia slide no. LMP 241; MNHU).

Costa Rica: *Puntarenas Province:* Osa Peninsula, Corcovado National Park, Sirena; Carara Biological Reserve, Estacion Quebrada Bonita, 50 m, UTM 194500,469850; (INBio and BMNH). **French Guiana:** Cayenne; St Jean du Maroni; (BMNH). **Venezuela:** Valera (USNM).

Northern form (39 specimens, including 9 ♂, 5 ♀ genitalia preparations)

Mexico: Chiapas, Suchiapa (UCB); Yucatan, Chichén Itzá [including 1 ♂ intermediate between northern form and typical form] (CMNH). **Guatemala:** [Izabal,] Cayuga (USNM). **Costa Rica:** *Guanacaste Province:* W. of Carmona Nicoya, 600–700 m; 8 km SW. of Cuajiniquil, Estacion Murcielago, 100 m; 31 km N. of Liberia, Fca Jenny, 300 m, W85° 34'27" N10° 51'55"; Santa Rosa National Park, 300 m (INBio and BMNH).

Form unidentified (3 ♀, not dissected)

Costa Rica: Avangarez (USNM); no further data (USNM). **Trinidad:** Caparo (BMNH).

***Nemoria tutala* (Dognin) comb. n.**

(Figs 37, 113, 140, 176–178, 241, 305–307)

Geometra tutala Dognin, 1898: 213. LECTO-TYPE ♂, ECUADOR (USNM), here designated [examined].

Racheospila tutala Dognin; Prout, 1932: 28.

ADULT (Fig. 37). Terminal line of wings orange brown in northern form, whereas this line is usually more reddish brown or a shade darker in *pacificaria*; the difference is very subtle. Front of fore tibia golden to mid brown. Dorsal spots of abdomen large, posterior spot sometimes heart-shaped.

GENITALIA ♂ (Figs 113, 140, 176–178, 241). Rod-like basal costal process of valva moderately slender and slightly spatulate or very slender; about three-quarters length of valva or as long as

valva. Valva with small process at free end, with numerous spinules and a hair-like tuft, near tip of midrib; midrib not divided into two distal branches, at most with a trace of branching. Aedeagus usually with narrower basal end than in *pacificaria*.

GENITALIA ♀ (Fig. 305–307). Sternite 7 usually largely covered by somewhat sclerotized area, occasionally without this, or (form C) with pair of patches; series of ridges on sternite usually finer and often more numerous than those of *pacificaria*, not defining sclerotized patches except in form C. Ductus bursae shorter than segment 7.

DIAGNOSIS. Discussed under *pacificaria*.

VARIATION. As in *pacificaria*, there is geographic variation in genitalic features of both sexes and three forms are termed here as A, B and C (see distribution below). Individual variation occurs also and tends to blur the distinctness of the three forms. In males of form B the basal costal process of the valva is stouter and with a blunt tip (Fig. 177) but this is often very slender and with a pointed tip in form A (Fig. 176) (though not in the lectotype, from Ecuador). The distal process projects from the extreme tip of the valva in form A but it arises from slightly below the tip in form B. Form C (based on a sole male from Mexico, Fig. 178) is intermediate in both characters.

In the female, ridges and wrinkles of sternite 7 are particularly apparent in the anterior half of the sternite (form A: Fig. 305), or in the posterior half (form B: Fig. 306). Form C (Fig. 307) resembles *pacificaria* in having sclerotized patches defined by the ridges but in other respects seems better placed in *tutala*.

BIOLOGICAL NOTES. Moths have been found at altitudes of 0–1100 m, in May to July, November and December (in Costa Rica).

DISTRIBUTION. Form A: from Colombia to French Guiana, Ecuador and Brazil. Form B: from south-eastern (Atlantic) Mexico to Costa Rica. Form C: south-western (Pacific) Mexico. Form B has a predominantly Atlantic distribution although within Costa Rica it extends also to Rincon de la Vieja National Park.

MATERIAL EXAMINED. Form A (17 specimens; including 5 ♂, 4 ♀ genitalia preparations)

Lectotype ♂, **Ecuador:** Loja area, 1891 (genitalia slide no. 57,576; Type No. 32609; USNM).

French Guiana: St Jean du Maroni (BMNH). **Venezuela:** San Esteban (BMNH). **Colombia:**

Muzo, 400–800 m (BMNH). **Brazil:** lower Amazon River, near Santarem, Taperinha; Matto Grosso State; *Santa Catarina:* Blumenau, Rio Laeiss; hills between Hansa and Jaragua, 400 m; Jaragua do Sul; Nova Bremen, 250 m; (BMNH). **Ecuador:** 1 ♂ (paralectotype), Loja area, 1891 (USNM).

Form B (23 specimens, including 6 ♂, 4 ♀ genitalia preparations)

Mexico: [Veracruz:] Jalapa; Misantla; (BMNH). **Guatemala:** [Izabel,] Cayuga; Chejel; (BMNH; CMNH; USNM). **Costa Rica:** [Alajuela Province:] Esperanza (USNM); *Guanacaste Province:* Rincon National Park, 4 km E. Casetilla, 750 m; *Heredia Province:* Puerto Viejo de Sarapiquí, Finca La Selva, 40 m; [Limón Province:] Guapiles (CMNH); N. edge Tortuguero National Park, Cerro Tortuguero, 0–100 m, UTM 285000,588000; *San José Province:* Braulio Carrillo National Park, Estacion Carrillo, 700 m; Braulio Carrillo National Park, La Montura, 1100 m; (INBio and BMNH unless stated otherwise).

Form C (4 specimens, including 1 ♂, 2 ♀ genitalia preparations)

Mexico: Jalisco, Estacion Biologia Chamela (UCB); Michoacan, 7 km S. Arteaga, c. 650 m (CMNH).

Other species in the genus

ADULT. Medium-sized for the genus and with white interantennal fillet, unless stated otherwise.

GENITALIA ♂. Hair-like coremata well developed on long sac unless stated otherwise. Coremata sometimes consisting of two types (brush of fine scales and brush of thin scales) but usually on the same sac. Saccus notched unless stated otherwise.

Nemoria acutularia (Schaus) comb. n.

(Figs 61, 114, 179, 242, 308)

Racheospila acutularia Schaus, 1912: 289. LECTOTYPE ♂, COSTA RICA (USNM), here designated [examined].

Racheospila thymeale Prout, 1932: 25. Holotype ♂, COSTA RICA (BMNH) [examined]. **Syn. n.**

ADULT (Fig. 61). Front of head mid brown with green patches in upper part; scattered orange brown scales at hind edge of interantennal fillet; area behind fillet green. Wing pattern plain with

slightly waved white antemedial and postmedial lines. Hind wing with veins M3 and CuA1 on short common stalk. Front of fore tibia golden brown with white bar distinct and complete. Abdomen with 3 white dorsal spots ringed with reddish brown.

GENITALIA ♂ (Figs 114, 179, 242). Basal costal process of valva short (about one-quarter length of valva), bluntly rounded; valva with distal end of costal sclerotization rounded and slightly produced. Juxta with papilla. Anellar plate ending in pair of short lobes with broad or deep excision in between.

GENITALIA ♀ (Fig. 308). Apophyses anteriores slightly more than half length of apophyses posteriores. Pouch joining ostium and sternite 7 large and semicircular, covering postostial plate. Ductus bursae shorter than segment 7.

DIAGNOSIS. *N. acutularia* resembles *defectiva* but the latter differs in having a green front of head and the middle spot on the abdomen is plain. All three spots are usually ringed with reddish brown in *acutularia* although the middle spot is not ringed in the lectotype. The male genitalia of *acutularia* (Fig. 179) are similar to those of several other species, in particular, *defectiva* (Fig. 186), though the tips of the socii are more blunt in the latter. *N. xaliria* (see the catalogue of extralimital species) also differs in minor genitalic features. Other similar species are *adaluzae*, which has all plain white dorsal spots on the abdomen, and *remota* and *consimilis*, which have dark spots (or none at all in some *remota* males); (see the catalogue of extralimital species for *consimilis*, and refer to the diagnoses of the other two species).

The female of *acutularia* has a larger pouch joining the ostium and sternite 7 than that of *defectiva* (compare Figs 308 and 314), and in neither is this deeply notched as in *adaluzae* (Fig. 276).

BIOLOGICAL NOTES. Moths have been found at altitudes of 600–1200 m, in June to August and October.

DISTRIBUTION. Known only from Costa Rica.

MATERIAL EXAMINED (15 specimens, including 6 ♂, 2 ♀ genitalia preparations)

Lectotype ♂ (*acutularia*), **Costa Rica:** [Cartago Province.] Tuis, v (genitalia slide no. 57,586; Type No. 17724; USNM). Holotype ♂ (*thymeale*), **Costa Rica:** [Cartago Province.] Orosi, 1200 m (*Fassl*) (genitalia slide Geom. 12892; BMNH).

Costa Rica: *Alajuela Province:* 2 km SW. of Dos Ríos, Finca San Gabriel, 600–650 m; 9 km S. of Santa Cecilia, Estacion Pitilla, 700 m; [*Cartago Province:*] Cachí, c. 1000 m; Juan Viñas; Orosi, 1200 m; 1 ♂ (*nympharia* paralectotype), Tuis (USNM); Tuis; *San José Province:* Braulio Carrillo National Park, Estacion Carrillo, 700 m; (INBio and BMNH unless stated otherwise).

***Nemoria adaluzae* sp. n.**

(Figs 67, 115, 180, 243, 276, 309, 338)

ADULT (Fig. 67). Front of head green, rarely mixed with straw. Interantennal fillet sometimes with a few scattered tan scales at hind edge; area behind fillet green. Wing pattern plain with waved white antemedial and postmedial lines. Hind wing with veins M3 and CuA1 on common stalk. Front of fore tibia straw to mid brown. Abdomen with 3 plain white dorsal spots, usually small, sometimes with trace of a fourth.

GENITALIA ♂ (Figs 115, 180, 243). Basal costal process of valva short (about one-quarter to one-third length of valva), tapered to a sharp point; valva with slight distal process. Juxta with papilla. Aedeagus with a short row of tiny spines. Sternite 8 with fairly shallow posterior notch.

GENITALIA ♀ (Figs 276, 309, 338). Apophyses anteriores about half length of apophyses posteriores. Pouch joining ostium and sternite 7 crescent-shaped; sternite 7 notched medially. Ductus bursae broadened and lightly sclerotized towards ostium; much longer than segment 7. Signum with curved to v-shaped line at opening.

DIAGNOSIS. *N. adaluzae* is one of the few Costa Rican *Nemoria* species that have plain white abdominal spots without any reddish surround. It is unlikely to be confused with *callirrhoe*, which lacks a distinct terminal line on the wings. Males of *adaluzae* lack the large dark brown distal process of the valva which can be seen without dissection in *priscillae* (Fig. 199). *N. adaluzae* has a slight distal process, very similar to those of *acutularia* and *defectiva*, but the basal costal process of the valva is pointed in *adaluzae* (Fig. 180) not rounded as in the other two species (see Fig. 179). *N. adaluzae* differs from those two species also in having spines on the aedeagus (Fig. 243).

The females examined (Fig. 276) are tentatively associated with *adaluzae*.

REMARKS. This species is named in honour of Ada Luz Marín Alpizar, member of the first female parataxonomist class at INBio.

BIOLOGICAL NOTES. Moths have been found at altitudes of 40–630 m, in February, June, August and September.

DISTRIBUTION. Known only from Costa Rica.

MATERIAL EXAMINED (8 ♂, 2 ♀; including 3 ♂, 2 ♀ genitalia preparations)

Holotype ♂, **Costa Rica:** Limón Province, 9.4 km W. Bribri, Suretka, 200 m, 9–11.vi.1983 (*Janzen & Hallwachs*) (genitalia slide no. LMP 259; INBio).

Paratypes. **Costa Rica:** *Heredia Province:* 6 ♂, Chilamate, 100 m, 11–13.viii.1986 (*Covell*) (CVCJ); 1 ♂, Puerto Viejo de Sarapiquí, La Selva Biol. Station, 40 m, vi.1987 (*Chavarria*) (INBio/BMNH).

Excluded from type-series. **Costa Rica:** *Alajuela Province:* 1 ♀, 16 km E. of Quebrada Grande, Finca San Gabriel, 630 m (INBio); *Heredia Province:* 1 ♀, Chilamate (CVCJ).

***Nemoria agenoria* (Schaus) comb. n., sp. rev.**

(Figs 64, 116, 181, 244, 310, 339)

Racheospila agenoria Schaus, 1912: 289. LECTOTYPE ♂, COSTA RICA (USNM), here designated [examined].

Racheospila fontalis ab. (?) *agenoria* Schaus; Prout, 1932: 27.

ADULT (Fig. 64). Front of head green and area behind interantennal fillet green; fillet bordered in front and behind with scattered orange-brown scales or with a narrow orange-brown band immediately behind. Wing pattern plain with waved white antemedial and postmedial lines. Hind wing with veins M3 and CuA1 on short common stalk. Abdomen with 4–5 white dorsal spots ringed with reddish brown, posterior spots small.

GENITALIA ♂ (Figs 116, 181, 244). Socii fairly narrow. Valva with costal side broadened along its whole length but particularly so at distal end; basal costal process slender and tapered, finely spinulose, nearly as long as valva. Juxta with papilla. Aedeagus with single large spine situated at one-third to one-quarter from apex of aedeagus.

GENITALIA ♀ (Fig. 310, 339). Apophyses anteriores slightly less than half length of apophyses posteriores. Without pouch joining ostium and sternite 7; ostium flanked by pair of large rounded sclerotized structures. Ductus bursae sclerotized, of similar length to segment 7.

DIAGNOSIS. *N. agenoria* is distinguished from most other plain-winged green-faced species in having more than three abdominal spots but it can only be separated from *florae* by genitalic features. The shape of the valva and basal process in the male (Fig. 181) and the structures flanking the female ostium (Fig. 310) are very distinctive.

BIOLOGICAL NOTES. Moths have been found at an altitude of c. 750 m, in January, June and November.

DISTRIBUTION. Known only from two localities in central Costa Rica.

MATERIAL EXAMINED (5 specimens; including 1 ♂, 2 ♀ genitalia preparations)

Lectotype ♂, **Costa Rica:** [Cartago Province,] Juan Viñas, xi (genitalia slide no. 57,585; Type No. 17725; USNM).

Costa Rica: [Cartago Province:] 1 ♂, 1 ♀, Juan Viñas; 2 ♀, Tuis, c. 750 m; (BMNH; USNM).

***Nemoria astraea* (Druce) comb. n.**

(Figs 40, 69, 117, 182, 245, 311)

Racheospila astraea Druce, 1892: 90. **LECTO-TYPE** ♂, MEXICO (USNM), here designated [examined].

ADULT (Fig. 40). Front of head salmon and tan or reddish brown; broad interantennal fillet with narrow green area behind. Wing pattern: large mottled pinkish brown blotch at inner margin of hind wing, with broad yellow border. White antemedial and postmedial lines slightly waved; without reddish brown terminal line or with only a trace. Hind wing with veins M3 and CuA1 meeting or separate. Front of fore tibia: lower two-thirds dark brown, upper part white. Abdomen mottled brown dorsally with short white dashes at posterior end of segments and white tip.

GENITALIA ♂ (Figs 117, 182, 245). Uncus spatulate; socii small and not normally erect. Genitalia simple: valva with straight parallel sides; basal costal process extremely short; without distal process; juxta without papilla; coremata very weakly developed; saccus rounded. Anterior margin of sternite 8 weakly concave.

GENITALIA ♀ (Fig. 311). Apophyses anteriores more than half length of apophyses posteriores. Postostial plate weak and ill-defined. Without pouch joining ostium and sternite 7. Ductus

bursae much shorter than segment 7; corpus bursae without signum.

DIAGNOSIS. *N. astraea* (Fig. 40) superficially resembles *interlucens* and *Synchlora astraeoides*, which have a similar blotch on the hind wing. However, *interlucens* (Fig. 41) has a series of brown dots instead of the white antemedial and postmedial lines on the wings while the wings of *S. astraeoides* are distinctively bordered by a strong terminal line. Two Mexican species, *capys* and *capysoides* (see extralimital catalogue) have a smaller blotch.

BIOLOGICAL NOTES. Moths have been found at altitudes of 500–1600 m, possibly to 1850 m, in Costa Rica (to c. 2000 m in Colombia); in February, May to August and October (in Costa Rica).

DISTRIBUTION. Widespread from Mexico to Venezuela and Peru.

MATERIAL EXAMINED (193 specimens; including 1 ♂, 1 ♀ genitalia preparations)

Lectotype ♂, **Mexico:** Veracruz, Paso de San Juan (coll. Schaus) (USNM).

Mexico: Jalapa; Misantla; Orizaba; Veracruz, Huatusco; (BMNH). **Guatemala** (BMNH). **Costa Rica:** *Alajuela Province:* 2 km W. of Dos Ríos, N. slope Volcán de Rincon, 550 m (UCB); 16 km ENE. of Quebrada Grande, Finca San Gabriel, 630 m, 650 m; 9 km S. of Santa Cecilia, Estacion Pitilla, 700 m; [Cartago Province:] Azahar de Cartago, c. 1550–1850 m; Cachí; Juan Viñas; Moravia de Chirripo, 1114 m; Orosi, 1200 m; Río Grande de Orosi, Tapanti, 1300–1400 m; Sitio; Tuis; 3 km SE. of Turrialba, CATIE, 600 m (UCB); *Guanacaste Province:* 11 km E. of Quebrada Grande, Colonia Refug. Los Angeles, Fca Biesnan, 500 m; Rincon National Park, 4 km E. of Casetilla; Volcán Cacao, SW. side, Estacion Cacao, 1100 m; *Puntarenas Province:* Monteverde, 1300–1400 m, c. 1250 m (CVCJ/BMNH; INBIO; UCB); 2 km E. of Monteverde, 1460 m (UCB); San Vito, Las Cruces Biol. Station; *San José Province:* Braulio Carrillo National Park, Estacion Carrillo, 700 m; Braulio Carrillo National Park, La Montura, 1100 m; 14 km N. of San Isidro del General Pan American Highway, 1600 m; near San José, La Uruca, 1100 m; [S. of San José.] Candelaria Mts; (INBio and BMNH unless stated otherwise). **Panama:** Chiriquí (BMNH). **Venezuela:** Caracas (BMNH). **Colombia:** slopes of Chocó, Río Siató, Siató, c. 1600 m (BMNH); Chocó, San Juan, La Selva, c. 1400 m (BMNH); Medina (BMNH); upper ('Ob.') Río Negro, 800 m (BMNH); Valle de Cauca, 4 km

NW. of San Antonio, c. 2000 m (UCB). **Ecuador:** Bolivar, Balzapamba (BMNH). **Peru:** Chanchamayo, La Merced (BMNH).

Nemoria callirrhoe (Prout) **comb. n.**

(Figs 65, 118, 183, 184, 246, 247, 312)

Racheospila callirrhoe Prout, 1932: 27. Holotype ♂, FRENCH GUIANA (BMNH) [examined].

ADULT (Fig. 65). Front of head green, often mixed with scattered brown scales. Interantennal fillet occasionally with one or two orange-brown scales at hind edge; area behind fillet green. Wing pattern plain with strongly waved white antemedial and postmedial lines; terminal line indistinct, olive or a trace of reddish brown; discal spot of fore wing well developed. Hind wing with veins M3 and CuA1 on common stalk. Front of fore tibia straw or pale brown without oblique white bar. Abdomen with up to 7 small plain white dorsal spots.

GENITALIA ♂ (Figs 118, 183, 184, 246, 247). Socii long and slender, not much shorter than uncus. Basal costal process of valva slender and rod-like (Fig. 183, eastern form; finely pointed in western form, Fig. 184), with strong bend or kink near base, longer than valva; distal process small and tooth-like (eastern form) or longer and spine-like (western form). Juxta with small papilla. Sternite 8 slightly notched between posterior lobes.

GENITALIA ♀ (Fig. 312). Apophyses anteriores half length of apophyses posteriores. Without distinct pouch joining ostium and sternite 7; ostial opening large, surrounded by concentric rings of ridges and folds. Ductus bursae much shorter than segment 7.

DIAGNOSIS. *N. callirrhoe* is one of the few Costa Rican species of *Nemoria* that have plain white abdominal spots without any reddish surround. It is distinguished from other such species in lacking a distinct terminal line on the wings. The male genitalia are highly distinctive, particularly the long narrow socii but also the processes of the valva (Figs 183, 184). *N. antipala* (see catalogue of extralimital species) has fairly similar processes but it has much broader socii and the wings have a distinct reddish terminal line. The female ostial opening of *callirrhoe* is unusually large (Fig. 312).

VARIATION. In addition to the variation in the processes of the valva described above, the aedeagus varies in having a short pointed apex in

the eastern form (Fig. 246) and a long pointed apex in the western form (Fig. 247). No females of the eastern form were available for comparison with the western form.

BIOLOGICAL NOTES. Moths have been found at altitudes of 40–750 m in Costa Rica (to 800 m in Colombia), throughout the year except in October (in Costa Rica).

DISTRIBUTION. Colombia and Costa Rica (western form); French Guiana (eastern form). Literature records: Panama (Prout, 1932: 27).

MATERIAL EXAMINED. Eastern form (1 ♂, including genitalia preparation)

Holotype ♂, **French Guiana:** St Jean du Maroni (genitalia slide Geom. 13301; BMNH).

Western form (28 specimens; including 3 ♂, 1 ♀ genitalia preparations)

Costa Rica: *Alajuela Province:* 16 km E. of Quebrada Grande, Finca San Gabriel, 600–650 m; 9 km S. of Santa Cecilia, Estacion Pitilla, 700 m, UTM 330200,380200; *Guanacaste Province:* Rincon National Park, 4 km E. of Casetilla, 750 m; *Heredia Province:* Braulio Carrillo National Park, Estacion El Ceibo, 400–600 m, UTM 527700,256500; Chilamate (CVCJ); Puerto Viejo de Sarapiquí, La Selva Biological Station, 40 m; *Limón Province:* N. edge Tortuguero National Park, Cerro Tortuguero, 100 m, UTM 285000,588000; *Puntarenas Province:* Osa Peninsula, Corcovado National Park, Sirena; *San José Province:* Braulio Carrillo National Park, Estacion Carrillo, 700 m; (INBio and BMNH unless stated otherwise). **Colombia:** upper ('Ob.') Río Negro, 800 m (BMNH).

Nemoria carolinae sp. n.

(Figs 35, 77, 119, 185, 248, 277, 313)

ADULT (Fig. 35). Front of head green; white interantennal fillet often with a few tan scales or very narrow band at hind edge; area behind fillet green. Wing pattern plain with waved white antemedial and postmedial lines. Hind wing with veins M3 and CuA1 on short common stalk. Front of fore tibia straw to mid brown, with oblique white bar sometimes reduced to half tibial width. Abdomen with 2 large blackish brown dorsal spots: posterior spot on segment 4, extending onto segment 5 but not onto segment 3; anterior spot on segment 1, extending onto segment 2.

GENITALIA ♂ (Figs 119, 185, 248). Valva long, extending well beyond tips of socii; basal costal process very short. Costal margin of valva

straight, giving rise at free end to small thin distal process tipped with two or three small claw-like spines. Juxta with papilla.

GENITALIA ♀ (Figs 277, 313). Apophyses anteriores half or more than half length of apophyses posteriores. Pouch joining ostium and sternite 7 large and oblong, with numerous curved parallel wrinkles in preostial region. Ductus bursae shorter than segment 7.

DIAGNOSIS. *N. carolinae* resembles the *pacificaria*-group superficially but the dark spots are positioned differently on the abdomen (see Figs 77 and 76). The distal process of the male valva (Fig. 185) is unique in form and the oblong pouch between the ostium and sternite 7 of the female (Fig. 313) is characteristic.

REMARKS. This species is named in honour of Carolina Cano Cano, member of the first female parataxonomist class at INBio.

BIOLOGICAL NOTES. Moths have been found at altitudes of 50–700 m, in February, March, May, July, September and October (in Costa Rica).

DISTRIBUTION. From Guatemala to Trinidad, Peru and Brazil.

MATERIAL EXAMINED (18 specimens; including 2 ♂, 3 ♀ genitalia preparations)

Holotype ♂, **Costa Rica:** [Alajuela Province] Esperanza, v (genitalia slide Geom. 12858; BMNH).

Paratypes. **Costa Rica:** *Alajuela Province:* 1 ♂, 2 ♀, 9 km S. of Santa Cecilia, Estacion Pitilla, 700 m, vii.1988, v.1989 (*Scoble & Brooks; GNP Biodiversity Survey*); [*Cartago Province:*] 1 ♀, Juan Viñas, ii (USNM); *Guanacaste Province:* 1 ♂, 11 km E. of Quebrada Grande, Colonia Refug. Los Angeles, Fca Biesnan, 500 m; *Heredia Province:* 1 ♀, Chilamate, 8.ix.1988 (*Covell*) (CVCJ); 1 ♀, Puerto Viejo de Sarapiquí, Finca La Selva (OTS), 50 m, 6–9.iii.1985 (*Janzen & Hallwachs*); [*Limón Province:*] 1 ♀, Sixaola River, iii; *Puntarenas Province:* 1 ♀, Carara Biological Reserve, Estacion Quebrada Bonita, 50 m, x.1989 (*Zúñiga*) 1 ♂, Osa Peninsula, Corcovado National Park, Sirena (*Janzen & Hallwachs*); 1 ♂, 35 km S. of Palmar Norte, Fila Esquinas, 150 m; (INBio and BMNH unless stated otherwise). **Panama:** 1 ♂, La Chorrera 1.iv–15.v.1898 (*Dolby-Taylor*) (BMNH). **Trinidad:** 1 ♂, Caparo, xi.1905 (*Klages*) (BMNH). **Venezuela:** 1 ♂, San Esteban, vi.1909 (*Klages*) (BMNH). **Ecuador:** 1 ♂, Pichincha Province, [near Santo Domingo,] Tinalandia, 700 m, 5–18.1985 (*Covell*) (CVCJ). **Peru:** 1 ♂, Ama-

zonas, Chachapoyas, 1889 (*de Mathan*) (BMNH). **Brazil:** 1 ♂, Pará (*Moss*) (BMNH).

***Nemoria defectiva* (Prout) comb. n., stat. n.**

(Figs 60, 79, 120, 186, 249, 314)

Racheospila dentilinea defectiva Prout, 1932: 27.

Holotype ♂, PERU (BMNH) [examined].

ADULT (Fig. 60). Front of head green (rarely mixed with brown); area behind interantennal fillet green; occasionally one or two tan scales near fillet. Wing pattern plain with waved white antemedial and postmedial lines weak between veins. Hind wing with veins M3 and CuA1 on short (occasionally extremely short) common stalk. Front of fore tibia straw or pale brown without oblique white bar. Abdomen (Fig. 79) with 2–3 small white dorsal spots plus traces at posterior end; middle spot of 3 plain, others ringed with reddish brown.

GENITALIA ♂ (Figs 120, 186, 249). Socii particularly broadly rounded. Basal costal process of valva short (less than one-quarter length of valva), bluntly rounded; valva with distal end of costal sclerotization slightly produced and usually more pointed than in *acutularia*. Juxta with papilla. Tufts of fine and thick coremata clearly differentiated. Anellar plate ending in slight excision or notch. Sternite 8 with posterior lobes often truncated and notch between them usually narrow.

GENITALIA ♀ (Fig. 314). Apophyses anteriores half, or slightly more than half, length of apophyses posteriores. Pouch joining ostium and sternite 7 broad and crescent-shaped, not more than partially covering postostial plate. Ductus bursae shorter than segment 7.

DIAGNOSIS. *N. defectiva* is most likely to be confused with *acutularia* and *dentilinea*. It differs from the former in the colour of the front of the head and from the latter in the absence (in Costa Rican specimens) of brown shading alongside the antemedial and postmedial lines of the wings (although faint brown shading is often present in Colombian and Peruvian specimens of *defectiva*). The male genitalia of *defectiva* and *acutularia* are very similar, differing mainly in the shape of the socii, which are like mouse ears in the former (Fig. 186). Neither species has the striking finger-like costal process of the male valva seen in *dentilinea*. The female of *defectiva* has a smaller pouch joining the ostium and sternite 7 than that of *acutularia* (compare Figs 314 and 308). (See also the diagnoses of *acutularia* and *dentilinea*.)

BIOLOGICAL NOTES. Moths have been found at altitudes of 40–800 m in Costa Rica (to c. 1050 m in Peru), in June to September and November to March (in Costa Rica).

DISTRIBUTION. Costa Rica, Colombia and Peru.

MATERIAL EXAMINED (36 specimens; including 10 ♂, 2 ♀ genitalia preparations)

Holotype ♂, **SE. Peru:** Carabaya, Tinguri, c. 1050 m ('3400 ft'), viii.1904 (*Ockenden*) (genitalia slide Geom. 13298; BMNH).

Costa Rica: *Alajuela Province:* 2 km SW. of Dos Ríos, Finca San Gabriel, 600 m (UTM 318800,3835000, 630 m, 650 m; 6 km NW. of Dos Ríos, E. side Volcán Cacao, Cerro Campana, 650 m; Río Sarapiquí, 6 km S. of San Miguel, 800 m (UCB); 9 km S. of Santa Cecilia, Estacion Pitilla, 700 m; *Heredia Province:* Chilamate (CVCJ); Puerto Viejo de Sarapiquí, Finca La Selva (OTS), 40, 50 m, UTM 268800,535300; *Puntarenas Province:* Osa Peninsula, Corcovado National Park, Sirena; *San José Province:* Carara Biological Reserve, Estacion Bijagual, 500 m; (INBio and BMNH unless stated otherwise). **Colombia:** Muzo, 400–800 m (BMNH). **Peru:** Carabaya, Tinguri, c. 1050 m; Río Inambari, La Oroya, c. 950 m; Yahuar mayo, c. 350 m; (BMNH).

***Nemoria dentilinea dentilinea* (Warren)
comb. n.**

(Figs 55, 121, 187–189, 250, 315)

Racheospila dentilinea Warren, 1897: 430. Holotype ♀, GUYANA (BMNH) [examined].

ADULT (Fig. 55). Front of head and area behind interantennal fillet green. Wing pattern plain apart from very faint shadowy brown band on inner side of strongly waved white antemedial and postmedial lines. Hind wing with veins M3 and CuA1 on common stalk. Front of fore tibia green mottled with pale brown; oblique white bar usually diffuse or reduced to spot. Abdomen with 3 white dorsal spots plus a trace between basal and 2nd; basal spot ringed with dark or reddish brown; [1 specimen has 2 additional white traces towards apex of abdomen].

GENITALIA ♂ (Figs 121, 187–189, 250). Costal side of valva evenly broadened but with at most a weak development of basal process. Distal process of valva finger-like, sometimes hooked or slightly bent, ranging from short, not approaching tip of valva, to extending well beyond valva; distal process (and to a lesser degree costal side of valva) finely spinulose. Juxta with papilla.

GENITALIA ♀ (Fig. 315). Apophyses anteriores slightly less than half length of apophyses posteriores. Pouch joining ostium and sternite 7 a shallow crescent bisected by deep notch in sternite. Ductus bursae shorter than segment 7, usually considerably so; with some sclerotization, usually very light in *d. dentilinea*.

DIAGNOSIS. No other species of *Nemoria* in Costa Rica has brown shading alongside waved antemedial and postmedial lines of the wings although some specimens of *defectiva* from Colombia and Peru have similar faint bands. The broad costa and finger-like distal process of the male genitalia of *dentilinea* are distinctive (Figs 187–189). *N. dentilinea* has two subspecies, *pau-rocaula* and *tenuilinea* (see catalogue of extralimital species); both of these, unlike the nominate subspecies, have a spine-like basal costal process of the valva.

VARIATION. The costal side and finger-like distal process of the male valva varies tremendously in length and shape. It ranges from much shorter than the other side of the valva (in Costa Rican specimens, e.g. as in Fig. 187) to considerably longer than the other side (in Venezuela, Fig. 188; French Guiana; Bolivia and one Colombian specimen). Other Colombian specimens and those examined from Ecuador, Peru and Brazil are intermediate in this character (Fig. 189).

BIOLOGICAL NOTES. Moths have been found at altitudes of 40–630 m in Costa Rica (to 1300 m in Bolivia), in March, August, October to January (in Costa Rica.)

DISTRIBUTION. Extending from Costa Rica to French Guiana, Brazil and Bolivia.

MATERIAL EXAMINED (74 specimens; including 11 ♂, 3 ♀ genitalia preparations)

Holotype ♀, **Guyana:** Río Demerara (genitalia slide Geom. 15576; BMNH).

Costa Rica: *Alajuela Province:* 16 km E. of Quebrada Grande, Finca San Gabriel, 630 m; *Heredia Province:* Chilamate, 100 m (CVCJ); Puerto Viejo de Sarapiquí, Finca La Selva (OTS), 40, 50 m; (INBio and BMNH unless stated otherwise). **French Guiana:** St Jean du Maroni (BMNH). **Venezuela:** San Esteban; near San Esteban, Las Quiguas; (BMNH). **Colombia:** Muzo, 400–800 m; Muzo, R. Cantinero, 400 m; upper ('Ob.') Río Negro, 800 m; (BMNH). **Ecuador:** Paramba (BMNH). **Peru:** Carabaya, Río Huacamayo, La Unión, c. 600 m; Yahuar mayo, c. 350 m; (BMNH). **Bolivia:** Charapaya ('Charaplaya'), 1300 m (BMNH); **Brazil:** Pará; Amazonas: Tefé ('Teffe'); Fonte Boa; Santo

Antonio de Javari; Sao Paulo de Olivença; (BMNH).

***Nemoria dorsilinea* (Schaus) comb. n.**

(Figs 48, 80, 122, 190, 251, 316, 340)

Racheospila dorsilinea Schaus, 1912: 289. LECTOTYPE ♂, COSTA RICA (USNM), here designated [examined].

ADULT (Fig. 48). Front of head and area behind broad interantennal fillet orange-brown. Wing pattern plain, striated, sometimes very faintly, with white and colourless flecks; with smooth white antemedial and postmedial lines; postmedials gently curved. Hind wing with veins M3 and CuA1 on common stalk or occasionally meeting. Front of fore tibia deep orange-brown shading to straw at inner edge; oblique white bar diffuse or reduced to spot. Abdomen without dorsal spots, instead with longitudinal cream stripe on abdomen and thorax (Fig. 80).

GENITALIA ♂ (Figs 122, 190, 251). Socii small, tapered and not normally erect. Genitalia simple; basal costal process of valva very weakly developed; valva without distal process; juxta without papilla; coremata very weakly developed; saccus rounded or slightly notched. Sternite 8 with slight posterior excision or fairly shallow notch; shorter than tergite.

GENITALIA ♀ (Figs 316, 340). Apophyses anteriores more than half length of apophyses posteriores. Without pouch joining ostium and sternite 7. Ductus bursae much shorter than segment 7. Signum a very narrow pouch.

DIAGNOSIS. *N. dorsilinea* is the only Neotropical species in this genus to have a whitish dorsal stripe (Fig. 80) instead of spots on the abdomen. A stripe of this sort, although rare in the Geometrinae, is seen in the North American *N. bifilata bifilata* (Walker) and in a few *Synchlora* species.

BIOLOGICAL NOTES. Moths have been found at altitudes of c. 2150–3100 m, in April, May and December.

DISTRIBUTION. Known only from high elevations in central Costa Rica.

MATERIAL EXAMINED (19 specimens; including 3 ♂, 1 ♀ genitalia preparations)

Lectotype ♂, Costa Rica: [San Jose Province,] Mount Poás, 2350 m, v (Type No. 17726; USNM).

Costa Rica: Alajuela Province: Volcán Poás, c. 2150 m, 2350 m; Cartago Province: Cerro de la

Muerte, 1 km NE. of Cerro Asuncion, 3100 m; Cerro de [la] Muerte, Pension La Georgina, 3000 m (UCB); San José Province: Cerro de la Muerte, San Gerardo de Dota, 2430 m; (INBio and BMNH unless stated otherwise).

***Nemoria duniae* sp. n.**

(Figs 28, 123, 191, 252, 317, 341)

ADULT (Fig. 28). Front of head green sometimes mottled with white, lower end whitish. Interantennal fillet sometimes largely overlaid with green scales; area behind fillet green, sometimes pale. Antennae with diffuse white dorsal line along basal half of flagellum; length of longest antennal branches in male exceeding four times width of flagellum at same point; flagellum slender. Wing pattern: faintly striated or mottled with whitish scales, without reddish brown terminal line. Antemedial and postmedial lines indistinct, broken into small diffuse patches of brown scales; hind wing with additional scattered brown scales. Hind wing with veins M3 and CuA1 separate. Front of fore tibia mid brown; white bar reduced to indistinct spot. Abdomen with one median dark brown dorsal spot, plus a trace at anterior end (female), or without spots (male).

GENITALIA ♂ (Figs 123, 191, 252). Socii triangular, pointed at apices. Basal costal process of valva short (one-quarter length of valva or less), truncated with finely serrated edge; distal process a rounded triangular shape, nearer middle than end of valva. Juxta without papilla. Coremata not discernible. Aedeagus slender and linear with a large patch of small spines on swollen apical half. Sternite 8 with slight rounded excision between posterior lobes; tergite 8 with shallow excision.

GENITALIA ♀ (Figs 317, 341). Apophyses anteriores short, less than one-third length of apophyses posteriores. Without pouch joining ostium and sternite 7. Ductus bursae large and funnel-shaped; sclerotized, particularly around ostial opening which has a pair of prominent ridges. Signum small with almost straight line at opening.

DIAGNOSIS. *N. duniae* (Fig. 28) resembles the typical form of *strigaria* (Fig. 27) externally and it may be related to that species though this is far from certain. Both are high elevation species. The two species differ in the colour of the front of the head and the processes of the male valva (Figs 191 and 165) are strikingly different. The large patch of spines on the aedeagus of *duniae* (Fig. 252) is also a distinctive feature.

REMARKS. This species is named in honour of Dunia Gricela García García, member of the first female parataxonomist class at INBio.

BIOLOGICAL NOTES. Moths have been found at an altitude of 2350 m, in December.

DISTRIBUTION. Known only from one high-elevation locality in central Costa Rica.

MATERIAL EXAMINED (2 ♂, 1 ♀; including 2 ♂, 1 ♀ genitalia preparations)

Holotype ♂, **Costa Rica**: Alajuela Province, Volcán Poás, 2350 m, 15.xii.1982 (*Janzen & Hallwachs*) (genitalia slide no. LMP 262; INBio).

Paratypes. **Costa Rica**: Alajuela Province, 1 ♂, 1 ♀, Volcán Poás, 2350 m, 19.xii.1981 (*Janzen & Hallwachs*) (BMNH/INBio).

Nemoria flaræ sp. n.

(Figs 59, 124, 192, 253, 278, 318)

ADULT (Fig. 59). Front of head in male mid brown with scattered green scales and green upper edge; in female completely green. Interantennal fillet of male with narrow diffuse orange-tan band at hind edge; this band merely a few scattered orange-tan scales in female; area behind fillet green. Wing pattern plain with waved white antemedial and postmedial lines. Hind wing with veins M3 and CuA1 on short common stalk. Front of fore tibia golden or orange brown; white bar reduced to indistinct spot in male, somewhat more distinct in female. Abdomen with 6–7 white dorsal spots ringed with reddish brown; posterior spots small or merely occurring as tan marks; spots sometimes weakly ringed and posterior spots fewer or less distinct in female.

GENITALIA ♂ (Figs 124, 192, 253). Uncus slightly spatulate. Basal costal process of valva short (about one-quarter length of valva), largely fused with valva, narrow. Costal margin of valva very weakly curved, with small but pronounced finely spinulose tooth-like distal process. Juxta with papilla. Tufts of fine and thick coremata clearly differentiated. Aedeagus with narrow pointed apex. Anellar plate with two slight rounded lobes. Sternite 8 with small slightly pointed posterior lobes.

GENITALIA ♀ (Figs 278, 318). Apophyses anteriores more than half length of apophyses posteriores. Pouch joining ostium and sternite 7 very large, extending posteriorly to a peak. Ductus bursae sclerotized, bulging in middle and near ostium; extending to anterior edge of segment 7.

Signum with straight or slightly curved line at opening.

DIAGNOSIS. *N. flaræ* can be distinguished from most other Costa Rican species by the supernumerary red-ringed white spots on its abdomen but green faced specimens can be separated from *agenoria* only by genitalic characters. The male genitalia of *flaræ* are characterized by the small spinulose distal process of the valva (Fig. 192); the large pouch joining the ostium and sternite is diagnostic in the female (Fig. 278). The female specimens examined are probably conspecific with the male holotype but I have excluded them from the type-series because there is no absolute certainty of this.

REMARKS. This species is named in honour of Flor Vianey Araya Mena, member of the first female parataxonomist class at INBio.

BIOLOGICAL NOTES. Moths have been found at altitudes of 600–1200 m, in May, June and August (in Costa Rica).

DISTRIBUTION. Costa Rica and Ecuador.

MATERIAL EXAMINED (2 ♂, 6 ♀; including 2 ♂, 2 ♀ genitalia preparations)

Holotype ♂, **Costa Rica**: San José Province, Braulio Carrillo National Park, Estacion Carrillo, 700 m, viii.1984 (*I. Chacon*) (genitalia slide no. LMP 263; INBio).

Paratype. **Costa Rica**: Alajuela Province, 1 ♂, Río Sarapiquí, 6 km S. of San Miguel, 800 m, 7.vi.1988 (*Brown & Powell*) (UCB).

Excluded from type-series. **Costa Rica**: *Alajuela Province*: 1 ♀, 2 km SW. of Dos Ríos, Finca San Gabriel, 600–650 m; 2 ♀, 9 km S. of Santa Cecilia, Estacion Pitilla, 700 m, UTM 330200, 380200; [*Cartago Province*]: 1 ♀, Orosi, 1200 m; *San José Province*: 1 ♀, locality as holotype; (INBio and BMNH). **Ecuador**: 1 ♀, Santo Domingo (BMNH).

Nemoria gerardinae sp. n.

(Figs 46, 125, 193, 254)

ADULT (Fig. 46). Front of head green with 2 white marks only just distinguishable; area behind interantennal fillet green. Wing pattern plain with white antemedial and postmedial lines smooth and faintly shaded with brownish green line on medial side; postmedial line of hind wing very weakly curved (not bent in middle or well curved as in most *Nemoria* species); without reddish brown terminal line. Hind wing with veins M3 and CuA1 separate. Front of fore tibia olive or pale brownish green without white bar.

Abdomen with 2 dark chestnut brown dorsal spots.

GENITALIA ♂ (Figs 125, 193, 254). Uncus spatulate; socii small. Basal costal process of valva short (less than one-quarter length of valva), tapered to a point; costal margin of valva very weakly curved; valva sometimes slightly swollen distally. Juxta without papilla. Corematal sacs slightly developed, without hair-like tufts. Saccus rounded. Anellar plate variable: with tapered or bifurcated lobe at apex. Sternite 8 with fairly shallow posterior notch.

♀. Unknown.

DIAGNOSIS. *N. gerardinae* can be recognised by the very weakly curved postmedial line of the hind wing (Fig. 46) and by the shading on the lines, although this is faint; the other external features described above help to characterize the species. A very weakly curved postmedial line is unusual in *Nemoria*, and particularly rare in Neotropical species, although it is seen in a few species such as *vermiculata* and *dorsilinea* which, unlike *gerardinae*, have striated wings. These striations may be faint in *dorsilinea* but the white stripe on the abdomen of that species distinguishes it from *gerardinae*. The male genitalia of *gerardinae* lack elaborate structures.

REMARKS. This species is named in honour of Gerardina Mayela Gallardo Ramírez, member of the first female parataxonomist class at INBio.

BIOLOGICAL NOTES. Moths have been found at altitudes of 1000–1800 m, in January, May and December.

DISTRIBUTION. Known only from central/southern Costa Rica.

MATERIAL EXAMINED (3 ♂, including 2 genitalia preparations)

Holotype ♂, Costa Rica: Cartago Province, Río Grande de Orosi, Tapanti, 1300–1400 m, 9° 46' x 83° 50', 23.i.1985 (Janzen & Hallwachs) (genitalia slide no. LMP 264; INBio).

Paratypes. Costa Rica: Cartago Province: 1 ♂, 16 km S. of San Isidro de Tejar, 3 km S. of Casa Mata, 1800 m, 4.xii.1983 (Janzen & Hallwachs); 1 ♂, Moravia de Chirripo, 1000 m, 10.v.1983 (Janzen & Hallwachs); (BMNH/INBio).

Nemoria interlucens (Schaus) comb. n.

(Figs 41, 126, 194, 255, 319)

Racheospila interlucens Schaus, 1912: 291. LECTOTYPE ♂, COSTA RICA (USNM), here designated [examined].

ADULT (Fig. 41). Front of head tan; interantennal fillet with tan band at hind edge and green area behind. Wing pattern: large mottled pinkish brown blotch at inner margin of hind wing, with broad yellow border. Antemedial and postmedial lines represented solely by brown dots on the veins. Hind wing with veins M3 and CuA1 separate. Front of fore tibia tan shading to straw towards outer edge, with white bar. Abdomen mottled brown dorsally with short white dashes at posterior end of segments and whitish tip.

GENITALIA ♂ (Figs 126, 194, 255). Socii triangular, pointed at apices. Basal costal process of valva a tapered blade curved at base, nearly as long as valva; costal margin of valva curved, with very small strongly spinulose distal process. Juxta with small papilla. Aedeagus with slender sharply pointed apical half.

GENITALIA ♀ (Fig. 319). Apophyses anteriores less than half length of apophyses posteriores. Without pouch joining ostium and sternite 7 but with thickening of membrane in this area; ostium surrounded by concentric rings of wrinkles. Ductus bursae slightly shorter than segment 7.

DIAGNOSIS. *N. interlucens* resembles the much commoner *astraea* (see diagnosis of that species) but has a series of brown dots on the wings instead of the white antemedial and postmedial lines of *astraea* (compare Figs 41 and 40). The male valva of *interlucens* (Fig. 194) is far more elaborate than that of *astraea* (Fig. 182).

BIOLOGICAL NOTES. Moths have been found at altitudes of c. 750–1700 m, in August and November.

DISTRIBUTION. Known only from central to southern Costa Rica.

MATERIAL EXAMINED (11 specimens; including 1 ♂, 1 ♀ genitalia preparations)

Lectotype ♂, Costa Rica: [Cartago Province:] Juan Viñas, xi (Type No. 17730; USNM).

Costa Rica: [Cartago Province:] Cachi (BMNH); 2 km E. of Moravia de Chirripo, 1150 m (CMNH); Orosi, 1200 m (BMNH); Tuis, c. 750 m (BMNH); San José Province: 16 km N. of San Isidro del General, 1700 m (CMNH).

Nemoria isabelae sp. n.

(Figs 54, 127, 195, 256)

ADULT (Fig. 54). The sole specimen examined (male) is smaller than average for *Nemoria*; fore wing length: 12 mm.

Front of head reddish brown with a trace of

green in upper half; interantennal fillet with reddish brown band at hind edge, and green area behind. Wing pattern plain with slightly waved white antemedial and postmedial lines. Hind wing with veins M3 and CuA1 on common stalk. Front of fore tibia pale brown with only a trace of white bar. Abdomen with 3 white dorsal spots ringed with reddish brown.

GENITALIA ♂ (Figs 127, 195, 256). Basal costal process of valva slender and rod-like with pointed denticulate tip, about four-fifths length of valva; costa broadened at free end of valva, forming irregular bowl-shape with edges and slightly bilobed distal process projecting from valva. Juxta with papilla. Coremata slightly developed; no hair-like tufts discernible. Aedeagus with slender sharply pointed apical half; with a few just discernible spines. Anellar plate broadly truncate. Sternite 8 with U-shaped posterior notch.

♀. Unknown.

DIAGNOSIS. *N. isabelae* resembles several other species but it can be distinguished by characters including front of head colour, hind wing venation and the weak bar on the front tibia. The distal process of the male valva (Fig. 195) is unique in form.

REMARKS. This species is named in honour of María Isabel Ortiz Campos, member of the first female parataxonomist class at INBio.

BIOLOGICAL NOTES. The moth was found at an altitude of 1350 m, in January.

DISTRIBUTION. Known only from one locality in central Costa Rica.

MATERIAL EXAMINED (1 ♂, including genitalia preparation)

Holotype ♂, **Costa Rica:** Heredia Province, 8.2 km downhill Vara Blanca, El Angel waterfall, 1350 m, 3.i.1981 (Janzen & Hallwachs) (genitalia slide no. LMP 265; INBio).

Nemoria marianellae sp. n.

(Figs 53, 128, 196, 257)

ADULT (Fig. 53). Known from just a single male specimen. Front of head tan with a few green scales near antennal scape, 2 white marks in lower corners. White interantennal fillet with green area behind. Wing pattern plain; antemedial and postmedial lines only just discernible. Hind wing with veins M3 and CuA1 on extremely short common stalk. Front of fore tibia pale brown without distinct white bar. Abdomen with

3 white dorsal spots: middle spot plain, others weakly ringed with reddish brown.

GENITALIA ♂ (Figs 128, 196, 257). Socii long. Valva fairly broad; basal costal process blade-like with finely serrated edges; about two-thirds length of valva, bent at base. Costal margin of valva straight, with distal end of sclerotization slightly produced. Juxta broadly funnel-shaped with papilla. Anellar plate consisting of a projection on each side of aedeagus. Sternite 8 very weakly notched between posterior lobes.

♀. Unknown.

DIAGNOSIS. *N. marianellae* resembles several other species but can be distinguished by the colour of the front of the head, the hind wing venation and the indistinct postmedial lines on the wings. The male genitalia have a characteristic ragged-edged basal costal process (Fig. 196); that of *saryae* (Fig. 163), which has a serrated tip, is more obviously bent and with the point of the bend more distal than in *marianellae*.

REMARKS. This species is named in honour of Marianella Segura Castillo, member of the first female parataxonomist class at INBio.

BIOLOGICAL NOTES. The moth was found in February.

DISTRIBUTION. Known only from one locality, in lower montane wet forest, in central Costa Rica.

MATERIAL EXAMINED (1 ♂, including genitalia preparation)

Holotype ♂, **Costa Rica:** [Cartago Province,] Juan Viñas, ii (genitalia slide LMP 235; CM).

Nemoria nympharia (Schaus) comb. n.

(Figs 57, 129, 197, 258, 320)

Racheospila nympharia Schaus, 1912: 290. **LECTOTYPE** ♀, **COSTA RICA** (USNM), here designated [examined].

ADULT (Fig. 57). Front of head mid brown with reddish tinge, sometimes flecked with green. Hind edge of interantennal fillet sometimes with a few tan scales, rarely a very narrow band; area behind fillet green. Wing pattern plain with fairly smooth (or very slightly waved) white antemedial and postmedial lines; without reddish brown terminal line or occasionally with very weak line. Hind wing with veins M3 and CuA1 on short (occasionally extremely short) common stalk. Front of fore tibia golden to darkish brown. Abdomen with 3 white dorsal spots ringed with reddish brown.

GENITALIA ♂ (Figs 129, 197, 258). Basal costal process of valva a slender rod tapered to a fine point; at least three-quarters length of valva; costal margin of valva broadly rounded and spinulose at tip. Juxta with broad papilla. Sternite 8 occasionally with only slight posterior notch.

GENITALIA ♀ (Fig. 320). Apophyses anteriores about half length of apophyses posteriores. Pouch joining ostium and sternite 7 large and crescent-shaped, bisected by notch in sternite; with semicircular wrinkles in preostial region. Ductus bursae extending almost to anterior edge of segment 7 or somewhat shorter.

DIAGNOSIS. *N. nympharia* is recognisable by its lack of a terminal line on the wings, unusual in a plain green species. The few other plain species in Costa Rica without a distinct terminal line have plain white or dark brown spots on the abdomen, whereas in *nympharia* these are white ringed with reddish brown. The broad spinulose tip of the male valva (Fig. 197) and the shape of the pouch joining the ostium and sternite 7 in the female are diagnostic.

REMARKS. *R. nympharia* was described from an unspecified number of males and females from Costa Rica: Juan Viñas, Sitio and Tuis. I have examined two specimens and designate the female labelled '♀ type' as the lectotype since the male ('Type No. 17727') from Tuis is conspecific with *acutularia*.

BIOLOGICAL NOTES. Moths have been found at altitudes of 1200–1700 m, in January, April to June and October to December (in Costa Rica).

DISTRIBUTION. Guatemala and Costa Rica.

MATERIAL EXAMINED (18 specimens; including 2 ♂, 4 ♀ genitalia preparations)

Lectotype ♀, **Costa Rica**: [*Cartago Province*:] Juan Viñas, vi (genitalia slide no. 57,575; USNM).

Guatemala: S. Geronimo (BMNH). **Costa Rica**: [*Cartago Province*:] Orosi, 1200 m; Río Grande de Orosi, Tapanti, 1300–1400 m, 9° 46' x 83° 50'; Tapanti, Campamiento Pejibaye, 1400 m; *Guanacaste Province*: Sitio, c. 1250 m; 9 km NW. of Turrialba, near Sta Cruz, Río Aquiares, 1500 m (UCB); *Puntarenas Province*: Monteverde; *San José Province*: Braulio Carrillo National Park, Estacion Zurquí (el Tunel), 1500 m, 10° 04'N, 84° 01'W; 16 km N. of San Isidro del General, 1700 m, 09° 25'N, 83° 43'W (CMNH); (INBio and BMNH unless stated otherwise).

Nemoria pescadora (Beutelspacher) **comb. n.**

(Figs, 47, 130, 198, 259, 321)

Phrudocentra pescadora Beutelspacher, 1984: 141. Holotype ♂, MEXICO: Jalisco, Estacion de Biología Chamela, 17–18.xi.1981 (*Pescador*) (Universidad Nacional Autónoma de México) [not examined].

ADULT (Fig. 47). Front of head predominantly reddish brown with 4 diffuse straw mottled patches (Mexican); golden straw mainly in centre shading to reddish brown mainly at edges (Costa Rican); area behind interantennal fillet green. Wing pattern: hind wing with very large discal spot; with white antemedial and postmedial lines smooth; without reddish brown terminal line, other than a trace on some Mexican moths. Hind wing distinctly angled at M3; veins M3 and CuA1 on very short common stalk. Front of fore tibia: lower half mid to dark brown, occasionally with green patch at outer edge; upper half white; upper edge of oblique white bar not always defined. Abdomen with 2 white dorsal spots, anterior spot ringed with reddish brown (Mexican form); without spots (Costa Rican form).

GENITALIA ♂ (Figs 130, 198, 259). Socii triangular, pointed at apices. Basal costal process of valva with long thin extension; about half length of valva or more; costal margin of valva straight or very slightly curved, with pointed, somewhat hook-like distal process. Juxta without papilla. Coremata weakly developed with few hair-like coremata apparent. Saccus truncate or slightly notched. Anellar plate usually with two projections, extending nearly to apex of aedeagus. Sternite 8 with fairly shallow posterior notch.

GENITALIA ♀ (Fig. 321). Apophyses anteriores half length of apophyses posteriores or less. Without pouch joining ostium and sternite 7; postostial plate much broader than ostium; ostial region with parallel curved wrinkles. Ductus bursae much shorter than segment 7.

DIAGNOSIS. *N. pescadora* is easily recognised by the large discal spots on the hind wing (Fig. 47). It was previously placed in *Phrudocentra* where one or two species have similar large spots but the angular white postmedial line of the hind wing, and genitalic features, are characteristic of *Nemoria*.

VARIATION. Costa Rican specimens differ from Mexican ones mainly in lacking spots on the abdomen.

BIOLOGICAL NOTES. Moths have been found at altitudes of 280–c. 1250 m in Costa Rica (to 1350 m in Mexico), in January, March, May to August, November and December (in Costa Rica).

DISTRIBUTION. Known from central Mexico and Costa Rica.

MATERIAL EXAMINED (43 specimens; including 5 ♂, 1 ♀ genitalia preparations)

Mexico: Guerrero, 16 km NW. of Iguala, 1160 m; Guerrero, 32 km W. of Iguala, 1350 m; Jalisco, Estacion Biologia Chamela; Sinaloa, 5 miles N. of Mazatlán; (UCB). **Costa Rica:** [Cartago Province:] Orosi; Guanacaste Province: Orosi, La Mariksa Hda, 550 m; Santa Rosa National Park, [1 ♀, H.Q. area, 280 m (UCB)]; W. of Carmona Nicoya, 600–700 m; Puntarenas Province: Monteverde, c. 1250 m (CVCJ; INBio/ BMNH); (INBio and BMNH unless stated otherwise).

Nemoria priscillae sp. n.

(Figs 66, 131, 199, 260)

ADULT (Fig. 66). Front of head green, rarely mixed with straw, usually with brown traces towards lower edge and occasionally towards upper edge. Interantennal fillet sometimes with a few scattered reddish brown scales at hind edge, rarely a diffuse band; area behind fillet green. Wing pattern plain with waved white antemedial and postmedial lines. Hind wing with veins M3 and CuA1 on common stalk. Front of fore tibia straw to mid brown; oblique white bar often indistinct. Abdomen with 3 small plain white dorsal spots, sometimes plus 2 traces.

GENITALIA ♂ (Figs 131, 199, 260). Uncus with notched tip. Basal costal process of valva very short; costal side of valva broadened; distal process of valva large and finger-like, curved outwards, extending beyond tips of valva and socii. Distal process and costal side of valva spinulose. Juxta with papilla; juxta giving rise to rounded lobe where it meets base of each valva. Tufts of fine and thick coremata clearly differentiated. Saccus deeply notched. Aedeagus slender and linear with a row of tiny spines. Tergite 8 with small notch.

♀. Unknown.

DIAGNOSIS. There are few *Nemoria* species in Costa Rica with plain white abdominal spots without any reddish surround. *N. priscillae* is unlikely to be confused with *callirrhoe*, which lacks a distinct terminal line on the wings, and

males of *priscillae* are readily distinguished by their large dark brown distal process of the valva which can be seen without dissection (Fig. 199).

REMARKS. This species is named in honour of Priscilla Campos Sanabría, member of the first female parataxonomist class at INBio.

BIOLOGICAL NOTES. Moths have been found at altitudes of 600–750 m, in February, April to June.

DISTRIBUTION. Known only from two localities in northern Costa Rica.

MATERIAL EXAMINED (5 ♂, including 3 genitalia preparations)

Holotype ♂, **Costa Rica:** Guanacaste Province, Rincon National Park, 4 km E. of Casetilla, 750 m, 11.iv.1983 (genitalia slide no. LMP 266; INBio).

Paratypes. **Costa Rica:** Alajuela Province, 4 ♂, 2 km SW. of Dos Ríos, Finca San Gabriel, 600 m (UTM 318800, 383500), 630 m, 8.ii.1983, vi.1988, v.1989 (Janzen & Hallwachs; GNP Biodiversity Survey) (INBio and BMNH).

Nemoria rectilinea (Warren) comb. n.

(Figs 33, 75, 132, 200, 261, 322)

Miantonota rectilinea Warren, 1906: 420. Holotype ♀, CUBA (USNM) [examined].

Racheospila rectilinea (Warren); Prout, 1932: 28.

ADULT (Fig. 33). Front of head with reddish brown edges, usually duller brown in centre; area behind interantennal fillet green. Wing pattern plain with fairly smooth white antemedial and postmedial lines. Hind wing with veins M3 and CuA1 on common stalk. Front of fore tibia straw to tan; oblique white bar sometimes indistinct. Abdomen (Fig. 75) with 2 dark brown dorsal spots: anterior spot large, median spot smaller.

GENITALIA ♂ (Figs 132, 200, 261). Basal costal process of valva very short (less than one-quarter length of valva); costal margin of valva with dense patch of spinules at tip. Juxta with papilla. Tufts of fine and thick coremata clearly differentiated.

GENITALIA ♀ (Fig. 322). Apophyses anteriores half, or slightly more than half, length of apophyses posteriores. Pouch joining ostium and sternite 7 semicircular; with semicircular wrinkles in preostial region; ostium flanked by pair of small circular or ring-shaped folds. Ductus bursae fairly long but not usually extending to anterior edge of segment 7. Sternite 7 with somewhat

sclerotized central area reminiscent of lizard skin in texture.

DIAGNOSIS. *N. rectilinea* can be distinguished from the externally similar *karlae* by the relative size of the spots on the abdomen; the anterior spot is larger than the more posterior (median) spot in *rectilinea* (Fig. 75) whereas the reverse is seen in *karlae* (Fig. 74) and also in *remota*. *N. rectilinea* has a distinctive clump of spinules at the tip of the male valva (Fig. 200) and the texture of sternite 7 in the female (Fig. 322) is also characteristic.

BIOLOGICAL NOTES. Moths have been found at altitudes of 300 – c. 1250 m, in February, March, May, July, August and November (in Costa Rica).

DISTRIBUTION. From Mexico to Panama; Cuba and Dominica.

MATERIAL EXAMINED (45 specimens; including 3 ♂, 4 ♀ genitalia preparations)

Holotype ♀, **Cuba**: [Oriente,] Baracoa, xii.1902 (genitalia slide no. 57,567; Type No. 9185; USNM).

Mexico: Jalapa (BMNH); Jalisco, Estacion Biologia Chamela (UCB). **Guatemala** (BMNH). **Costa Rica:** *Alajuela Province*: 2 km SW. of Dos Ríos, Finca San Gabriel, 600 m (UTM 318800,383500), 630 m, 650 m; [*Cartago Province*:] Cachi; Orosi, 1200 m; Sitio (CMNH); *Guanacaste Province*: 4 km W. of Santa Cecilia, 300 m; Rincon National Park, 4 km E. of Casetilla, 750 m; Santa Rosa National Park; Volcán Cacao, SW. side, Estacion Cacao ('Mengo'), 1100 m, W85° 28'10", N10° 55'43"; *Puntarenas Province*: Monteverde; Monteverde, c. 1250 m (CVCJ); San Vito, Las Cruces Biol. Station, 1200 m; (INBio and BMNH unless stated otherwise). **Panama:** La Chorrera (BMNH). **Dominica** (BMNH).

***Nemoria remota* (Warren) comb. n.**

(Figs 49, 133, 201, 262, 323)

Racheospila remota Warren, 1900: 139. Holotype ♂, COSTA RICA (BMNH) [examined].

ADULT (Fig. 49). Front of head and area behind interantennal fillet green. Wing pattern plain with slightly waved white antemedial and post-medial lines; without reddish brown terminal line except (rarely) a trace on hind wing. Hind wing with veins M3 and CuA1 on short common stalk or occasionally meeting. Front of fore tibia straw often mixed with dark brown; oblique white bar occasionally indistinct. Abdomen with dark

brown or blackish dorsal spots: tiny trace at anterior end; median spot large in females and usually small in males; spots sometimes absent in males.

GENITALIA ♂ (Figs 133, 201, 262). Basal costal process of valva short (one-quarter length of valva or less), usually rounded, never sharply pointed; distal margin of sclerotization of valva forming ridge across small rounded distal process of valva [except one specimen]. Juxta with papilla. Saccus sometimes only weakly notched. Tergite 8 sometimes with very slight excision.

GENITALIA ♀ (Fig. 323). Apophyses anteriores more than half length of apophyses posteriores. Pouch joining ostium and sternite 7 large and crescent-shaped to semicircular. Ductus bursae shorter than segment 7.

DIAGNOSIS. A few other plain-winged Costa Rican species lack white spots on the abdomen but *remota* is distinguished from these by its green front of head, together with the slightly waved white postmedial line and weak or absent terminal line of its wings. The male genitalia (Fig. 201) are similar to those of *acutularia* (Fig. 179), which has white abdominal spots, and *consimilis*, which does not occur in Costa Rica, but neither of those two species have the distal margin of sclerotization of the valva forming a ridge across the distal process. The female genitalia of *remota* and *acutularia* are extremely similar.

BIOLOGICAL NOTES. Moths have been found at altitudes of 600 – c. 1850 m, in January to March, May to August, November and December (in Costa Rica).

DISTRIBUTION. Widespread from Mexico to Colombia. Literature records by Prout (1932: 28) from Venezuela and Brazil require confirmation.

MATERIAL EXAMINED (185 specimens; including 7 ♂, 2 ♀ genitalia preparations)

Holotype ♂, **Costa Rica:** Azahar de Cartago, c. 1550–1850 m ('5000–6000 ft') (*Underwood*) (genitalia slide Geom. 12861; BMNH).

Mexico: Misantra (BMNH); Veracruz, 5 km W. Jalapa, near San Andrés, 1600 m (UCB). **Guatemala:** Huehuetenango, Municipio Santa Cruz, Barillas, Chiblac, c. 1000 m (BMNH). **Costa Rica:** *Alajuela Province*: 8 km W. of Atenas, 1000 m (UCB); 7 km NW. of Dos Ríos, El Ensayo, Finca La Campana, 700 m; 5 km NW. of Dos Ríos, Finca Campana, 750 m; 2 km SW. of Dos Ríos, Finca San Gabriel, 600 m (UTM 318800,383500), 630 m, 650 m; 6 km NW. of Dos

Ríos, E. side Volcán Cacao, Cerro Campana, 650 m; Río Sarapiquí, 6 km S. of San Miguel, 800 m (UCB); 9 km S. of Santa Cecilia, Estacion Pitilla, 700 m, UTM 330200,380200; Volcán Poás, N/NE. slope, 8 km N. of Vara Blanca, 1400 m (UCB), 1450 m (UCB), 1300 m; [*Cartago Province*:] Juan Viñas, c. 750 m; Moravia de Chirripo, 1000 m, 1114 m; 2 km E. of Moravia de Chirripo, 1150 m (CMNH); Orosi, 1200 m; Río Grande de Orosi, Tapanti, 1300–1400 m, 9° 46' x 83° 50'; Sitio, c. 1250 m; Tuis; *Guanacaste Province*: Rincon National Park, 4 km E. of Casetilla, 750m; Rincon National Park, Mirador Ad., 900 m; Volcán Cacao, SW. side, Estacion Cacao ('Mengo'), 1100 m, W85o, 28'10", N10o, 55'43"; *Puntarenas Province*: Monteverde, 1300–1400 m; San Vito, Las Cruces Biol. Station, 1200 m; Z.P. Las Tablas, Tajo Cafrosa, 1300 m; *San José Province*: Braulio Carrillo National Park, Estacion Carrillo, 700 m; Braulio Carrillo National Park, La Montura, 1100 m; 14 km N. of San Isidro del General Pan American Highway, 1600 m; [S. of San José.] Candelaria Mts. (INBio and BMNH unless stated otherwise) UCB). **Panama**: Volcán de Chiriquí (BMNH). **Colombia**: Muzo, 400–800 m (BMNH).

Nemoria rosae sp. n.

(Figs 45, 279, 324, 342)

ADULT (Fig. 45). Known from just a single female specimen. Front of head and area behind interantennal fillet reddish brown. Wing pattern plain but with pronounced reddish terminal line with yellowish border and fringes; terminal line somewhat scalloped, giving outer margins of wings a chequered appearance; with white antemedial and postmedial lines smooth. Discal spot of hind wing well developed. Hind wing with veins M3 and CuA1 on short common stalk. Front of fore tibia reddish brown with white upper tip. Abdomen mottled reddish brown and yellow ochre dorsally with diffuse whitish traces.

♂. Unknown.

GENITALIA ♀ (Figs 279, 324, 342). Apophyses anteriores more than half length of apophyses posteriores. Without pouch joining ostium and sternite 7; ostium surrounded by small ridges and wrinkles. Ductus bursae much shorter than segment 7; corpus bursae very slender with only small bulbous tip. Signum with V-shaped line at opening to narrow pouch.

DIAGNOSIS. The chequered reddish brown and yellow wing margins of *rosae* are highly distinc-

tive and the species is unlikely to be confused with any other.

REMARKS. This species is named in honour of Rosa María Guzmán Adanís, member of the first female parataxonomist class at INBio.

BIOLOGICAL NOTES. The moth was found at an altitude of 1300 m, in May.

DISTRIBUTION. Known only from one locality in Costa Rica.

MATERIAL EXAMINED (1 ♀, including genitalia preparation)

Holotype ♀, **Costa Rica**: Puntarenas Province, Monteverde, 1300 m, 17–20.v.1985 (*Chemsak & Opler*) (genitalia slide no. LMP 230; CAL).

Nemoria toxeres (Prout)

(Figs 56, 81, 134, 202, 263, 325)

Racheospila lixaria toxeres Prout, 1932: 25. Holotype ♂, COSTA RICA (BMNH) [examined]. *Nemoria toxeres* (Prout); Ferguson, 1969: 78.

ADULT (Fig. 56). Front of head reddish brown usually with duller brown centre. Interantennal fillet with reddish or orange tan band or at least scattered scales at hind edge, and green area behind. Wing pattern plain with very slightly waved white antemedial and postmedial lines. Hind wing with veins M3 and CuA1 on short common stalk. Front of fore tibia golden, reddish, or mid brown with white upper tip with white bar distinct and complete. Abdomen (Fig. 81) with 3 white dorsal spots strongly ringed with reddish or dark brown; often with tan patch joining posterior two spots and extending towards posterior end of abdomen or sometimes towards both ends, particularly in females.

GENITALIA ♂ (Figs 134, 202, 263). Basal costal process of valva short (about one-quarter length of valva); distal process rounded and extending across costal side of valva as a fin-like ridge, near free end of valva. Juxta with papilla. Tufts of fine and thick coremata clearly differentiated. Aedeagus with a prominent sinuous row of small spines along well sclerotized strip.

GENITALIA ♀ (Fig. 325). Apophyses anteriores slightly more than half length of apophyses posteriores. Pouch joining ostium and sternite 7 shallow, bisected by notch in sternite; ostial region with parallel rows of deep wrinkles; ostium with broad straight lip. Ductus bursae sclerotized progressively towards ostium and smooth apart from a few longitudinal folds; longer than segment 7.

DIAGNOSIS. Specimens of *toxeres* with particularly strongly ringed spots on the abdomen are only likely to be confused with *vinocincta*, which differs in having more strongly waved postmedial lines and separate hind wing veins M3 and CuA1. More weakly marked moths resemble *acutularia* but that species has green patches on the upper part of the front of its head. In the male genitalia the distal process extends as a fin-like ridge across the valva (Fig. 202), and the spines of the aedeagus (Fig. 263) are characteristic. *N. modesta* (from Mexico and Guatemala) and the North American species *zelotes* Ferguson (from southern Arizona and New Mexico) have similar genitalia and appear to be closely related to *toxeres* but the shapes of the processes of the male valva differ. The smoothly sclerotized ostium and its lip in female *toxeres* differ from those of other species occurring in Costa Rica.

BIOLOGICAL NOTES. Moths have been found at altitudes of 650–1500 m, in December to March and May to September (in Costa Rica).

DISTRIBUTION. Costa Rica. Literature records: Jamaica (Prout, 1932: 25); Mexico (Ferguson, 1969: 78).

MATERIAL EXAMINED (64 specimens; including 4 ♂, 1 ♀ genitalia preparations)

Holotype ♂, **Costa Rica:** [Cartago Province,] Juan Viñas, ii (genitalia slide Geom. 5697; BMNH).

Costa Rica: *Alajuela Province:* 16 km, ENE. of Quebrada Grande, Finca San Gabriel, 650 m; NE. slope Volcán Poás, 8 km N. of Vara Blanca, 1400 m (UCB); [*Cartago Province:*] Las Cóncevas; Juan Viñas (BMNH; CMNH); Orosi, 1200 m; 9 km NW. of Turrialba, near Sta Cruz, Río Aquiares, 1500 m (UCB); *Guanacaste Province:* Rincon National Park, 4 km E. of Casetilla, 750 m; Volcán Cacao, SW. side, Estacion Cacao ('Mengo'), 1100 m, W85° 28'10" N10° 55'43"; Volcán Cacao, W. side, Estacion Cacao, Derumbe, 1400 m; *Puntarenas Province:* Monteverde, c. 1250 m, 1350–1400 m (INBio; BMNH; CVCJ; UCB); *San José Province:* Braulio Carrillo National Park, Estacion Carrillo, 700 m; Braulio Carrillo National Park, Estacion Zurquí (el Tunel), 1500 m, 10° 04'N, 84° 01'W. (INBio and BMNH unless stated otherwise).

***Nemoria venezuelae* (Prout) comb. n., stat. n.**

(Figs 58, 135, 203–205, 266, 326)

Racheospila fontalis venezuelae Prout, 1932: 27.

LECTOTYPE ♂, VENEZUELA (BMNH), here designated [examined].

Racheospila sectifimbria Prout, 1932: 27. Holotype ♂, PERU (BMNH) [examined]. **Syn. n.**

ADULT (Fig. 58). Front of head green; interantennal fillet with narrow tan band at hind edge, and green area behind. Wing pattern plain with waved white antemedial and postmedial lines, sometimes faint except for dots on veins. Outer margin of fore wing very slightly curved. Hind wing with veins M3 and CuA1 on short common stalk. Front of fore tibia straw or pale brown without white bar. Abdomen with 3 white dorsal spots ringed with reddish brown; posterior spot small, often with only trace of a ring.

GENITALIA ♂ (Figs 135, 203–205, 266). Uncus slightly spatulate or with notched tip; socii fairly narrow. Costal side of valva broadened, increasing distally, but without separate basal process. Distal processes of valva consisting of finely spinulose lobe (continuation of broadened costa) and smooth lobe. Juxta with papilla. Corematal sac not long. Saccus sometimes only weakly notched. Aedeagus with single large triangular spine, serrated at edges, situated at about one-quarter from apex of aedeagus. Sternite 8 with very long triangularly pointed posterior lobes converging; tergite 8 with excision between rounded lobes.

GENITALIA ♀ (Fig. 326). Apophyses anteriores less (usually slightly) than half length of apophyses posteriores. Pouch joining ostium and sternite 7 an extremely large crescent; postostial plate large; ostium with lip tapered to one or two slight peaks, flanked by pair of small sclerotized lobes. Ductus bursae sclerotized progressively towards ostium, with some transverse wrinkling on one side; curved or sinuous, longer than segment 7.

DIAGNOSIS. *N. venezuelae* is one of many species that have waved postmedial lines and three white abdominal spots ringed with reddish brown. The green front of head and tan band behind the interantennal fillet help to distinguish it. In males of this species the pointed projections of sternite 8 are distinctive (Fig. 135) and can usually be seen without dissection, if a few scales are carefully brushed away. The pointed tips are close together, not wide apart as in *winniae* (Fig. 138). In the female of *venezuelae* the ostial area and sclerotization of the ductus bursae are characteristic (Fig. 326).

VARIATION. There is considerable variation in the male genitalia. In form A, rare in Costa Rica, the distal processes of the valva are narrow and

the finger-like spinulose lobe extends to the tip of the valva or slightly beyond (Figs 203, 204). The distal processes are broader in the form common in Costa Rica (form B), and the squat spinulose lobe does not extend to the tip of the valva (Fig. 205). Females show no significant variation.

REMARKS. The basal costal process of the male valva must have been secondarily lost or modified if this species is correctly assigned to *Nemoria*.

BIOLOGICAL NOTES. Moths have been found at altitudes of 40–1700 m, in January, July to September and November (in Costa Rica).

DISTRIBUTION. Form A extends from Guatemala and Belize to French Guiana, Brazil and Peru but appears to be rare in Costa Rica. Form B is known only from Costa Rica.

MATERIAL EXAMINED Form A (66 specimens; including 5 ♂, 1 ♀ genitalia preparations)

Lectotype ♂ (*venezuelae*), **Venezuela:** San Esteban, vi.1909 (*Klages*) (genitalia slide Geom. 13979; BMNH). Holotype ♂ (*sectifimbria*), **SE. Peru:** Río Inambari, La Oroya, c. 950 m ('3100 ft') (genitalia slide Geom. 13983; BMNH).

Guatemala: (USNM). **Belize:** Punta Gorda. **Costa Rica:** *Heredia Province:* Chilamate, 100 m (CVCJ); Puerto Viejo de Sarapiquí, La Selva Biological Station, 40 m (INBio). **French Guiana:** 1 ♂ (*fontalis venezuelae* paralectotype), St Jean du Maroni (BMNH). **Venezuela:** including 9 ♂, 2 ♀ (*fontalis venezuelae* paralectotypes), San Esteban (BMNH). **Colombia:** Gorgona I., c. 60 m; including 4 ♂ (*fontalis venezuelae* paralectotypes), upper ('Ob.') Río Negro, 800 m; (BMNH). **Peru:** Río Inambari, La Oroya, c. m, 900, 950 m; Yahuar Mayo, c. 250 m; (BMNH). **Brazil:** Pará (BMNH).

Form B (9 specimens; including 4 ♂, 2 ♀ genitalia preparations)

Costa Rica: *Alajuela Province:* 9 km S. of Santa Cecilia, Estacion Pitilla, 700 m; [*Cartago Province:*] Tuis; *Heredia Province:* Braulio Carrillo National Park, Estacion El Ceibo, 400–600 m, UTM 527700, 256500; Puerto Viejo de Sarapiquí, La Selva Biological Station, 40 m; *San José Province:* Braulio Carrillo National Park, Estacion Carrillo, 700 m; 16 km N. of San Isidro del General, 1700 m, 09° 25'N, 83° 43'W (CMNH); (INBio and BMNH unless stated otherwise).

***Nemoria vermiculata* (Dognin) comb. n., stat. rev.**

(Figs 43, 44, 136, 206, 264, 327)

Lissochlora vermiculata Dognin, 1914: 380. LECTOTYPE ♂, COLOMBIA (USNM), here designated [examined].

Nemoria mustela monostigma Prout, 1916: 166. Holotype ♂, COLOMBIA (BMNH) [examined]. [Synonymy cited by Prout, 1932: 36.]. *Racheospila mustela vermiculata* (Dognin); Prout, 1932: 36.

ADULT (Figs 43, 44). Fairly small moths, fore wing length: ♂, 12 mm; ♀, 13 mm.

Front of head salmon-coloured; interantennal fillet with salmon area behind; hind edge of head sometimes green. Wing pattern: striated with white and colourless flecks; with white antemedial and postmedial lines smooth, postmedials pronounced and almost straight; discal spot absent from hind wing; costa brown; fringe yellowish, particularly obvious in male. Mottled brown and pink spot on inner side of each line, at inner margin of fore wing; occasionally almost run together in female; spots tiny and antemedial spot sometimes absent in male. Female with pinkish brown blotch at dorsal margin of hind wing, stretching between lines or broken in middle, and smaller blotch at anal angle. Hind wing with veins M3 and CuA1 on very short common stalk. Front of fore tibia salmon-coloured. Male with dark brown dorsal spot at anterior end of green abdomen; female abdomen mottled brown and salmon pink dorsally, paler on middle two segments, sometimes with 3–5 tiny white spots.

GENITALIA ♂ (Figs 136, 206, 264). Uncus spatulate; socii triangular. Basal costal process of valva short (one-quarter to one-third length of valva), tapered. Costal side of valva particularly heavily sclerotized; costal margin curved, pointed at free end but without distinct distal process. Juxta without papilla. Coremata not discernible. Saccus without distinct notch. Anellar plate tapered, extending nearly to apex of aedeagus. Sternite 8 very weakly notched between posterior lobes.

GENITALIA ♀ (Fig. 327). Apophyses anteriores half length of apophyses posteriores. Pouch joining ostium and sternite 7 a very shallow crescent, bisected by deep notch in sternite. Ductus bursae extending almost to anterior edge of segment 7. Signum very small and weak. **DIAGNOSIS.**

Both sexes of *N. vermiculata* can be distinguished from other species by external features:

the brown markings on the wings, straight post-medial lines and the dorsal markings of the abdomen.

VARIATION. There is pronounced sexual dimorphism in the colour pattern of the wings and abdomen (Figs 43, 44). Females (Fig. 44) have far more brown markings on the wings including a more pronounced terminal line, and the abdomen is brown dorsally.

BIOLOGICAL NOTES. Moths have been found at altitudes of 1200–3100 m, in May, August and December (in Costa Rica).

DISTRIBUTION. Central Costa Rica and Colombia.

MATERIAL EXAMINED (12 ♂, 16 ♀; including 3 ♂, 1 ♀ genitalia preparations)

Lectotype ♂ (*vermiculata*), **Colombia**: Cordillera Oriental, Pacho, 2200 m (*Fassl*) (genitalia slide no. 57,563; Type No. 32587; USNM). Holotype ♂ (*monostigma*), **Colombia**: San Cajetano, c. 2450 m ('8000 ft'), ix.1902 (genitalia slide Geom. 14089; BMNH).

Costa Rica: *Cartago Province*: Cerro de la Muerte, 1 km NE. of Cerro Asuncion, 3100 m; Cerro de [la] Muerte, Pension La Georgina, 3000 m (UCB); Orosi, 1200 m; Volcán Irazú, 2400 m; *San José Province*: Cerro de la Muerte, San Gerardo de Dota, 2430 m. (INBio and BMNH unless stated otherwise). **Colombia**: 1 ♂ (*vermiculata* paralectotype), Pacho, 2200 m (*Fassl*) (USNM).

Nemoria vinocincta (Warren) **comb. n.**

(Figs 50, 51, 137, 207, 208, 265, 328, 343)

Racheospila vinocincta Warren, 1901: 450. Holotype ♀, PANAMA (BMNH) [examined].

ADULT (Figs 50, 51). Front of head reddish brown, 2 large white marks in lower corners. Interantennal fillet with reddish brown area behind; hind edge of head sometimes green. Length of longest male antennal branches up to three times width of flagellum at same point. Wing pattern plain with faint waved white ante-medial and postmedial lines; wings pale green with pronounced reddish brown broken terminal line and reddish brown costa of fore wing in high altitude form. Hind wing with veins M3 and CuA1 separate. Front of fore tibia darkish brown (usually reddish in high altitude form); oblique white or cream bar sometimes weak. Abdomen with 3 white dorsal spots strongly ringed with reddish or dark brown (middle spot slightly elongated in high altitude form); dorsal ground

colour sometimes predominantly brown (reddish brown in high altitude form) with green confined to side edges, otherwise with a tan patch surrounding posterior two spots.

GENITALIA ♂ (Figs 137, 207, 208, 265). Socii somewhat tapered. Basal costal process of valva a tapered blade curved near base; less than one-third length of valva to nearly as long as valva. Valva with distal end of costal sclerotization slightly produced or forming a distinct lobe. Juxta with papilla. Coremata weakly developed. Sternite 8 slightly notched between posterior lobes.

GENITALIA ♀ (Fig. 328, 343). Apophyses anteriores slightly less than half length of apophyses posteriores. Without pouch joining ostium and sternite 7; ostium surrounded by concentric rings of wrinkles. Ductus bursae extending almost to anterior edge of segment 7 or much shorter. Signum with small irregularly U-shaped line and a couple of short adjoining lines at opening to pouch.

DIAGNOSIS. The costal band and terminal line of the high altitude form is distinctive. Weakly marked forms may be confused with *toxeres* which has similar abdominal markings (differences are discussed under that species). The genitalia of the two species are dissimilar.

VARIATION. *N. vinocincta* ranges from a conspicuously marked form with pale green wings, a strong reddish brown costal band and a pronounced though broken terminal line, occurring at an altitude of about 3000 m, to a weakly marked (standard *Nemoria*) form at lower altitudes. The male basal costal process ranges from shortest at the highest altitude to long and of variable shape at lower altitudes. Although the extremes are highly disparate I consider that they should probably be regarded as conspecific since intermediate forms exist both in external markings and in the genitalic character.

BIOLOGICAL NOTES. Moths have been found at altitudes of 1100–3100 m; in March to June (high altitude form, at 3000–3100 m); January, February, July, August, October and December (other forms, at 1100–2430 m) (in Costa Rica).

DISTRIBUTION. Costa Rica and Panama.

MATERIAL EXAMINED (26 specimens; including 10 ♂, 2 ♀ genitalia preparations)

Holotype ♀, **Panama**: Chiriquí (BMNH).

Costa Rica: *Alajuela Province*: Volcán Poás, 2350 m; *Guanacaste Province*: Volcán Cacao, SW. side, Estacion Cacao ('Mengo'), 1100 m,

W85° 28'10", N10° 55'43"; *San José Province*: Braulio Carrillo National Park, Estacion Zurquí (el Tunel) 1500 m, 10° 04'N, 84° 01'W; Cerro de la Muerte, San Gerardo de Dota, 2430 m; (INBio and BMNH.)

High altitude form

Costa Rica: *Cartago Province*: Cerro de la Muerte, 1 km NE. of Cerro Asuncion, 3100 m; Cerro de [la] Muerte, Pension La Georgina, 3000 m (UCB); *San José Province*: Villa Mills, 3100 m. (INBio and BMNH unless stated otherwise.)

Nemoria winniae sp. n.

(Figs 52, 82, 138, 209, 267, 329, 344)

ADULT (Fig. 52). Medium-sized to large, fore wing length: ♂, 17–18 mm; ♀, 20 mm.

Front of head reddish brown, 4 large cream marks. Broad interantennal fillet with reddish brown area behind; hind edge of head green. Length of longest male antennal branches up to or exceeding four times width of flagellum at same point; female antennae also bipectinate though with shorter branches than in male. Wing pattern plain apart from pronounced unbroken dark reddish brown terminal line. Antemedial and postmedial lines just discernible as pale traces. Hind wing distinctly angled at M3; veins M3 and CuA1 separate. Front of fore tibia mid brown with white upper tip. Abdomen (Fig. 82) with 3 pronounced elongate white dorsal spots ringed with chestnut brown, 2nd & 3rd spots sometimes fused; brown markings continued to form diffuse longitudinal stripe; few green markings, those present are pale green.

GENITALIA ♂ (Figs 138, 209, 267). Uncus slightly spatulate; socii small. Basal costal process of valva short (about one-quarter length of valva), rounded; costal margin of valva curved, with slight distal swelling. Juxta without papilla. Saccus weakly notched. Anellar plate with two long projections (reminiscent of coat tails). Sternite 8 with pronounced triangularly pointed posterior lobes diverging.

GENITALIA ♀ (Figs 329, 344). Apophyses anteriores more than half length of apophyses posteriores. Pouch joining ostium and sternite 7 crescent-shaped; postostial plate continuous with cup-shaped sclerotization of ostial opening. Ductus bursae much shorter than segment 7. Signum with ring shaped opening to very small pouch.

DIAGNOSIS. The highly pronounced terminal line together with the distinctly angulate hind wing distinguish *winniae* at a glance. This striking

species differs also from all other *Nemoria* species in having bipectinate antennae in the female, and in the elongate abdominal spots. The male genitalia, rather simple and with small socii (Fig. 209), are similar to those of *gerardinae* (Fig. 193) although that species has a smaller, more pointed, basal costal process.

REMARKS. This species is named in honour of Winnie Hallwachs, technical advisor to INBio and faculty member of the INBio parataxonomists' courses.

BIOLOGICAL NOTES. Moths have been found at altitudes of 1400–1500 m, in July, November and December.

DISTRIBUTION. Known only from two localities in Costa Rica.

MATERIAL EXAMINED (2 ♂, 1 ♀; including 1 ♂, 1 ♀ genitalia preparations)

Holotype ♂, **Costa Rica**: San José Province, Braulio Carrillo National Park, Estacion Zurquí (el Tunel), 1500 m, 10° 04'N, 84° 01'W, xi.1985 (*I. & A. Chacon*) (genitalia slide no. LMP 267; INBio).

Paratypes. **Costa Rica**: 1 ♂, Puntarenas Province, Monteverde, 1300–1400 m, 20–21.vii.1982 (*Janzen & Hallwachs*); San José Province, 1 ♀, same locality as holotype, xii.1985 (*I. & A. Chacon*) (BMNH/INBio).

CATALOGUE OF EXTRALIMITAL NEOTROPICAL SPECIES OF *NEMORIA*, *LISSOCHLORA* AND *CHAVARRIELLA*

Distribution records are based on specimens examined in the BMNH collection, or on the type-specimens, unless stated otherwise. Records not confirmed by dissection or by distinctive external features are queried.

CHAVARRIELLA gen. n.

Chavarriella brunneilinea (Prout) **comb. n.**

Racheospila brunneilinea Prout, 1912: 109. Holotype ♂, PERU: [Puno,] Río Inambari, La Oroya, c. 950 m ('3100 ft'), iii.1905 (*Ockenden*) (BMNH) [examined].

Racheospila semiornata ab. *brunneilinea* Warren, 1907: 209. [Infrasubspecific name.]

DISTRIBUTION. French Guiana; Colombia; Peru; Bolivia; Brazil.

***Chavarriella excelsa* (Dognin) comb. n.**

Racheospila excelsa Dognin, 1910: 19. LECTOTYPE ♂, COLOMBIA: [Valle,] Alto de las Cruces, 2200 [2700?] m, iii.1909 (Type No. 32602; USNM), here designated [examined].

REMARKS. Described from 2 ♂; the paralectotype is from San Antonio, near Cali.

DISTRIBUTION. Colombia.

***Chavarriella lafayaria lafayaria* (Dognin) comb. n.**

Comibaena lafayaria Dognin, 1892: 206. Holotype ♂, ECUADOR: Loja area, 1891 (Type No. 32600; USNM) [examined].

Racheospila lafayaria (Dognin); Prout, 1932: 37.

DISTRIBUTION. Ecuador.

***Chavarriella lafayaria promontoria* (Warren) comb. n.**

Racheospila promontoria Warren, 1904a: 26. LECTOTYPE ♂, SE. PERU: Carabaya, Santo Domingo, c. 1850 m ('6000 ft'), xii.1901 (*Ockenden*) (genitalia slide no. 14013; BMNH), here designated [examined].

Racheospila promontoria dilata Prout, 1916: 164. Holotype ♂, NE. PERU: near Cerro de Pasco, Huancabamba (*Boettger*) (BMNH) [examined]. **Syn. n.**

Racheospila lafayaria promontoria Warren; Prout, 1932: 37.

REMARKS. *R. promontoria* is possibly a synonym of *lafayaria*.

DISTRIBUTION. Peru. Literature record: Bolivia (Prout, 1932: 37).

***Chavarriella lugentiscripta lugentiscripta* (Prout) comb. n.**

Racheospila lugentiscripta Prout, 1917a: 117. LECTOTYPE ♂, W. COLOMBIA: San Antonio, c. 1550 m ('5800 ft'), xii.1907 (*Palmer*) (BMNH), here designated [examined].

DISTRIBUTION. Colombia.

REMARKS. *C. lugentiscripta* is related to *lafayaria*.

***Chavarriella lugentiscripta dubia* (Prout) comb. n.**

Racheospila lugentiscripta dubia Prout, 1917a: 117. Holotype ♂, ECUADOR: Intaj (*Buckley*) (BMNH) [examined].

DISTRIBUTION. Ecuador.

***Chavarriella luteifimbria* (Dognin) comb. n.**

Racheospila luteifimbria Dognin, 1901: 309. Holotype ♂, COLOMBIA: [Cauca,]

Popayan, 1896 (Type No. 32601; USNM) [examined]. DISTRIBUTION. Colombia.

***Chavarriella pelops* (Prout) comb. n.**

Racheospila pelops Prout, 1932: 37. Holotype, BRAZIL: Espiritu Santo, 3.ix.1920 (*Zikan*) (Seit) [not examined].

DISTRIBUTION. Brazil.

***Chavarriella psittacina* (Prout) comb. n.**

Racheospila psittacina Prout, 1910: 237. Holotype ♂, E. PERU: Huancabamba, Cerro del Pasco (BMNH) [examined].

DISTRIBUTION. Peru.

***Chavarriella sophrosyne* (Prout) comb. n.**

Racheospila sophrosyne Prout, 1932: 36. Holotype ♂, BRAZIL: Rio Janeiro (BMNH) [examined].

DISTRIBUTION. Brazil.

***Chavarriella syncrasis* (Prout) comb. n.**

Racheospila conflua Warren, 1904b: 506. Holotype ♂, PERU: Cerro de Pasco, Huancabamba, c. 1850–3100 m ('6–10000 ft') (*Böttger*) (genitalia slide Geom. 14069) (BMNH) [examined]. [Junior homonym of *Racheospila conflua* Warren, 1904b: 502.]

Racheospila syncrasis Prout, 1912: 108. [Replacement name.]

DISTRIBUTION. Peru.

***Chavarriella trianteris* (Prout) comb. n.**

Racheospila trianteris Prout, 1932: 36. Holotype ♂, BRAZIL: Sao Paulo, Alto da Serra, 29–30.x.1927 (*Zerny*) (NM) [not examined].

DISTRIBUTION. Literature record: Brazil (Prout).

***Chavarriella urania* (Herbulot) comb. n.**

Nemoria urania Herbulot, 1988b: 121; fig. 9. Holotype ♂, PERU: San Martin, 386 km on route Olmos-Tarapoto, 1800 m, 14–15.ii.1982 (*Porion*) (HERB) [not examined].

REMARKS. Herbulot (1988b: 121) rightly stated that *urania* is related to *psittacina*; I suspect that it may be a synonym.

DISTRIBUTION. Literature record: Peru (Herbulot).

LISSOCHLORA Warren, 1900**The albociliaria-group*****Lissochlora paegnii* (Prout) comb. n., stat. n.**

Racheospila hoffmannsi paegnii Prout, 1932: 33. LECTOTYPE ♂, SE. PERU: Carabaya, Oconeque, c. 2150 m ('7000 ft'), vii.1904 (genitalia slide Geom. 14008; BMNH), here designated [examined].

DISTRIBUTION. Peru; Bolivia?.

***Lissochlora pectinifera* (Prout) comb. n.**

Racheospila pectinifera Prout, 1916: 158. Holotype ♂, PERU: Carabaya, Santo Domingo, c. 2000 m ('6500 ft'), x.1902 (*Ockenden*) (genitalia slide Geom. 14003; BMNH) [examined].

REMARKS. Variation occurs in the female genitalia.

DISTRIBUTION. Peru; Bolivia?. Literature record: Panama (Prout, 1932: 33) requires confirmation.

***Lissochlora purpureotincta* (Warren) comb. n.**

Racheospila purpureotincta Warren, 1900: 138. LECTOTYPE ♂, VENEZUELA: Palma Sola (genitalia slide no. 14022; BMNH), here designated [examined].

Racheospila purpureoviridis Warren, 1904a: 26. [Incorrect subsequent spelling of *purpureotincta* Warren.]

DISTRIBUTION. French Guiana; Guyana?; Trinidad?; Venezuela; Colombia; Bolivia; Paraguay; Brazil. Literature record: Ecuador (Warren, 1900: 139).

***Lissochlora quotidiana* (Prout) comb. n.**

Racheospila quotidiana Prout, 1932: 33. Holotype ♂, SE. BRAZIL: Novo Friburgo (genitalia slide Geom. 14021; BMNH) [examined].

DISTRIBUTION. Peru?; Bolivia?; Brazil.

The diarita-group***Lissochlora bryata* (Felder & Rogenhofer) comb. n.**

Nemoria bryata Felder & Rogenhofer, 1875: pl. 127, fig. 12. Lectotype ♂ [cited as ♀], COLOMBIA: Bogota, 1854 (*Lindig*) (BMNH), designated [as 'the type'] by Prout (1932: 30) [examined].

Aplodes flavifimbria Warren, 1897: 423. Holotype ♂, COLOMBIA: Bogota (genitalia slide Geom. 15017; BMNH) [examined]. **Syn. n.**

Geometra iguala Dognin, 1898: 214. Holotype ♂, ECUADOR: Loja (genitalia slide no.

57,580; Type No. 32584; USNM) [examined]. **Syn. n.**

Lissochlora albifimbriata Dognin, 1913: 8. Holotype ♂, COLOMBIA: [Cundinamarca,] Bogota, 2800–3200 m (*Fassl*) (genitalia slide no. 57,561; Type No. 32585; USNM) [examined]. **Syn. n.**

Racheospila bryata resurgens Prout, 1932: 30. Holotype ♂, COLOMBIA: Central Cordillera, Paso del Quindiu, 3500m (*Fassl*) (genitalia slide no. Geom. 15016; BMNH) [examined]. **Syn. n.**

REMARKS. Prout (1932: 30) viewed *flavifimbriata* and *albifimbriata* as probable aberrations of *bryata*.

DISTRIBUTION. Colombia; Ecuador. Literature record: Mexico (Delfin-González & Beutelspacher, 1986b: 426 as *flavifimbria*) needs confirmation.

***Lissochlora cecilia* (Prout) comb. n.**

Racheospila cecilia Prout, 1912: 106. Holotype ♂, E. PERU: Cushi, 1820 m (genitalia slide Geom. 15096; BMNH) [examined].

Racheospila carmen Prout, 1916: 161. Holotype ♂, PERU: Prov. Huanuco, Cushi, 1900 m (*Hoffmanns*) (genitalia slide Geom. 14814; BMNH) [examined]. **Syn. n.**

Racheospila montana Prout, 1916: 161. LECTOTYPE ♂, PERU: Carabaya, Agualani, c. 2700 m ('9000 ft'), viii.1905 (*Ockenden*) (genitalia slide Geom. 15093; BMNH), here designated [examined]. **Syn. n.**

Racheospila montana tenuilinea Prout, 1916: 162. LECTOTYPE ♂, PERU: Carabaya, Oconeque, c. 2150 m ('7000 ft'), vii.1904 (*Ockenden*) (genitalia slide Geom. 15094; BMNH), here designated [examined]. [Junior homonym of *Oenospila tenuilinea* Kaye, 1901: 147.]

Racheospila montana smaragdina Prout, 1916: 162. LECTOTYPE ♂, PERU: Huancabamba, Cerro de Pasco (*Boettger*) (genitalia slide Geom. 15095; BMNH), here designated [examined]. **Syn. n.**

Racheospila montana araeomita Prout, 1932: 31 [examined]. [Replacement name for *tenuilinea* Prout.] **Syn. n.**

REMARKS. *L. cecilia* has similar male genitalia to *nigricornis*. *R. montana*, *tenuilinea* and *smaragdina* were all described from an unspecified number of specimens.

DISTRIBUTION. Peru.

***Lissochlora diarita* (Dognin) comb. n.**

Geometra diarita Dognin, 1898: 214. LECTO-

TYPE ♂, ECUADOR: Loja area, 1891 (genitalia slide no. 57,598; Type No. 32589; USNM), here designated [examined].

Racheospila diarita (Dognin); Prout, 1932: 30.

REMARKS. Described from 2 ♂; the paralectotype is not conspecific with the lectotype.

DISTRIBUTION. Ecuador. Literature records: Mexico (Delfín-González & Beutelspacher, 1986b: 427); Costa Rica to Bolivia; Argentina; Brazil; (Prout, 1932: 30). The record from Costa Rica is probably based on a misidentification; the other literature records may also be unreliable since the identity of *diarita* has been confused in the past.

Lissochlora eugethes (Prout) **comb. n.**

Racheospila eugethes Prout, 1912: 106. Holotype ♂, E. PERU: Huancabamba, Cerro del Pasco (genitalia slide Geom. 15097; BMNH) [examined].

Racheospila neodmes Prout, 1916: 160. Holotype ♂, PERU: Carabaya, Agualani, c. 2700 m ('9000 ft'), x.1905 (*Ockenden*) (genitalia slide Geom. 14000; BMNH) [examined]. **Syn. n.**

REMARKS. Closely related to *diarita* or possibly a synonym.

DISTRIBUTION. Peru; Bolivia?.

Lissochlora mollissima (Dognin) **comb. n.**

Nemoria mollissima Dognin, 1892: 186. LECTOTYPE ♂, ECUADOR: Loja area, 1891 (genitalia slide no. 57,596; Type No. 32583; USNM), here designated [examined].

DISTRIBUTION. Ecuador.

Lissochlora nigricornis Warren **comb. rev.**

Lissochlora? *nigricornis* Warren, 1907: 204. Holotype ♂, PERU: Province Huanuco, Cushi, 1900 m (*Hoffmanns*) (genitalia slide Geom. 14002; BMNH) [examined].

Racheospila nigricornis Warren; Prout, 1932: 30.

DISTRIBUTION. Peru.

Lissochlora nortia (Druce) **comb. rev.**

Synchlora (?) *nortia* Druce, 1892: 93. Holotype ♂, MEXICO: Veracruz, Paso de San Juan (coll. Schaus) (genitalia slide no. 57,592; Type No. 11897; USNM) [examined].

Racheospila nortia Druce; Prout, 1932: 30.

REMARKS. Warren (1900: 135) cited *nortia* as probably belonging in *Lissochlora*.

DISTRIBUTION. Mexico.

Lissochlora pasama (Dognin) **comb. n.**

Geometra pasama Dognin, 1898: 214. LECTO-

TYPE ♂, ECUADOR: near Loja, El Monje, 1893 (genitalia slide no. 57,597; Type No. 32586; USNM), here designated [examined].

Racheospila pasama (Dognin); Prout, 1932: 30.

REMARKS. *L. pasama* has similar male genitalia to *latuta*.

DISTRIBUTION. Ecuador. The literature record by Prout (1932: 30) from Peru is unconfirmed; several specimens that I have examined are not conspecific with *pasama*.

Lissochlora viridifimbria Dognin **comb. rev.**

Lissochlora viridifimbria Dognin, 1911b: 161.

LECTOTYPE ♂, COLOMBIA: [Valle,] San Antonio, 1700 m, iii.1909 (*Fassl*) (genitalia slide no. 57,581; Type No. 32588; USNM), here designated [examined].

Racheospila viridifimbria (Dognin); Prout, 1932: 29.

REMARKS. The male genitalia resemble those of *bryata*.

DISTRIBUTION. Colombia; Ecuador?.

Lissochlora viridilinea viridilinea (Prout) **comb. n.**

Racheospila viridilinea Prout, 1916: 162. LECTOTYPE ♂, PERU: Carabaya, Santo Domingo, c. 1850 m ('6000 ft'), v.1902 (*Ockenden*) (genitalia slide Geom. 15091; BMNH), here designated [examined].

DISTRIBUTION. Peru.

Lissochlora viridilinea cushiensis (Prout) **comb. n.**

Racheospila viridilinea cushiensis Prout, 1932: 31. Holotype ♂, E. PERU: Huanuco, Cushi, 1900 m (*Hoffmanns*) (genitalia slide Geom. 15092; BMNH) [examined].

DISTRIBUTION. Peru.

Lissochlora vividata (Prout) **comb. n.**

Racheospila vividata Prout, 1932: 30. LECTOTYPE ♂, SE. PERU: Carabaya, Río Inambari, La Oroya, c. 950 m ('3100 ft'), ix.1904 (*Ockenden*) (genitalia slide Geom. 13758; BMNH), here designated [examined].

REMARKS. The male genitalia resemble those of *viridilinea*.

DISTRIBUTION. Peru; Bolivia?.

Other species in the genus

Lissochlora alboseriata (Warren) **sp. rev., comb. n.**

Racheospila alboseriata Warren, 1900: 138. LECTOTYPE ♂, VENEZUELA: Merida (*Bri-*

ceno) (genitalia slide Geom. 14812; BMNH), here designated [examined].
Racheospila dispilata Dognin, 1914: 380. Holotype ♂, E. COLOMBIA: Medina, 500 m (genitalia slide no. 57,571; Type No. 32579; USNM) [examined]. **Syn. n.**

REMARKS. *R. alboseriata* was incorrectly cited as a synonym of *liriata* by Prout (1932: 32).

DISTRIBUTION. Venezuela; Colombia.

Lissochlora calida (Dognin) **comb. n.**

Geometra calida Dognin, 1898: 216. Holotype ♂, ECUADOR: Loja area, 1891 (genitalia slide no. 57,570; Type No. '325702'; USNM) [examined].

Racheospila calida (Dognin); Prout, 1932: 34.

DISTRIBUTION. Ecuador.

Lissochlora discipuncta (Warren) **comb. n.**

Rhodochlora discipuncta Warren, 1900: 140. Holotype ♂, BOLIVIA: La Paz, x.1895 (*Stuart*) (genitalia slide Geom. 14811; BMNH) [examined].

Racheospila discipuncta (Warren); Prout, 1932: 32.

DISTRIBUTION. Bolivia.

Lissochlora hena (Dognin) **comb. n.**

Racheospila hena Dognin, 1898: 217. Lectotype ♂, ECUADOR: Loja area, 1892 (genitalia slide no. 57,574; Type No. 32590; USNM), designated [as 'the type'] by Prout (1932: 34) [examined].

Racheospila plenifimbria Dognin, 1910: 20. LECTOTYPE ♂, [Valle,] COLOMBIA: near Cali, San Antonio, (*Fassl*) (genitalia slide no. 57,578; Type No. 32581; USNM), here designated [examined]. **Syn. n.**

Racheospila hena ab. *duplex* Prout, 1932: 34. [Infrasubspecific name.]

DISTRIBUTION. Colombia; Ecuador; Peru.

Lissochlora hoffmannsi (Prout) **comb. n.**

Racheospila hoffmannsi Prout, 1932: 33. LECTOTYPE ♂, E. PERU: Prov. Huanuco, Cushi, 1900 m (*Hoffmanns*) (genitalia slide Geom. 14009; BMNH), here designated [examined].

DISTRIBUTION. Peru.

Lissochlora jenna jenna (Dognin) **comb. n.**

Racheospila jenna Dognin, 1898: 216. LECTOTYPE ♂, ECUADOR: Loja area, 1890 (Type No. 32577; USNM), here designated [examined].

DISTRIBUTION. Colombia; Ecuador; Peru.

Lissochlora jenna salubris (Prout) **comb. n.**

Racheospila jenna salubris Prout, 1932: 34. Holotype ♂, COLOMBIA: Central Cordillera, Paso del Quindiu, 3500 m (*Fassl*) (BMNH) [examined].

DISTRIBUTION. Colombia.

Lissochlora jocularia (Dognin) **comb. n.**

Racheospila jocularia Dognin, 1923: 15. LECTOTYPE ♂, ECUADOR: Loja area, 1890 (genitalia slide no. 57,587; Type No. 32580; USNM), here designated [examined].

DISTRIBUTION. Ecuador.

Lissochlora licada (Dognin) **comb. n.**

Geometra licada Dognin, 1898: 215. LECTOTYPE ♂, ECUADOR: Loja area, 1890 (genitalia slide no. 57,564; Type No. 32575; USNM), here designated [examined].

Racheospila licada (Dognin); Prout, 1932: 34.

DISTRIBUTION. Ecuador.

Lissochlora liriata (Dognin) **comb. n.**

Geometra liriata Dognin, 1898: 213. LECTOTYPE ♂, ECUADOR: Loja area, 1891 (genitalia slide no. 57,573; Type No. 32578; USNM), here designated [examined].

Racheospila liriata (Dognin); Prout, 1932: 32.

DISTRIBUTION. Ecuador. Literature records by Prout (1932: 32) from Venezuela and Colombia refer to *L. alboseriata* which I have now removed from synonymy with *liriata*. Prout's records from Mexico and Peru may also be based on misidentifications.

Lissochlora molliculata (Warren) **comb. n.**

Racheospila molliculata Warren, 1904a: 26. LECTOTYPE ♂, SE. PERU: Carabaya, Santo Domingo, c. 1850 m ('6000 ft'), i.1902 (*Ockenden*) (genitalia slide Geom. 14010; BMNH), here designated [examined].

REMARKS. *L. molliculata* has similar male genitalia to *calida*.

DISTRIBUTION. Ecuador?; Peru.

Lissochlora monospilonota (Prout) **comb. n.**

Racheospila monospilonota Prout, 1916: 160. Holotype ♂, COLOMBIA: Monte Tolima, 3200 m, ii.1910 (*Fassl*) (BMNH) [examined].

DISTRIBUTION. Colombia.

Lissochlora multiseriata (Dognin) **comb. n.**

Racheospila multiseriata Dognin, 1923: 16. LECTOTYPE ♂, BOLIVIA: Río Songo, 750 m (*Fassl*) (genitalia slide no. 57,595; Type No.

32599; USNM), here designated [examined].

REMARKS. *L. multiseriata* is similar to *punctiseriata* but has an extra row of dots towards the outer margins of the wings.

DISTRIBUTION. Bolivia.

Lissochlora nigripes (Dognin) **comb. n.**

?*Prasinocyma nigripes* Dognin, 1911a: 23. LECTOTYPE ♂, COLOMBIA: Paramo del Quindin, 3800 m, ix.1909 (*Fassl*) (genitalia slide no. 57,572; Type No. 32597; USNM), here designated [examined].

Racheospila nigripes (Dognin); Prout, 1932: 32).

REMARKS. *L. nigripes* has similar male genitalia to *licada*.

DISTRIBUTION. Colombia.

Lissochlora punctiseriata (Dognin) **comb. n.**

Blechroma punctiseriata Dognin, 1910: 18. LECTOTYPE ♂, COLOMBIA: near Cali, Alto de las Cruces/'Andes', 2300 m, i.1909 (*Fassl*) (genitalia slide no. 57,594; Type No. 32598; USNM), here designated [examined].

Blechroma florifera Prout, 1910: 232. LECTOTYPE ♂, W. COLOMBIA: San Antonio, c. 1550 m ('5800 ft'), xii.1907 (*Palmer*) (genitalia slide Geom. 15609; BMNH), here designated [examined]. **Syn. n.**

Racheospila punctiseriata (Dognin); Prout, 1932: 34.

REMARKS. In describing *B. florifera*, Prout referred to it as a close relative, possibly a form, of *punctiseriata*. *L. punctiseriata* has similar male genitalia to *licada*.

DISTRIBUTION. Colombia.

Lissochlora rhodonota (Prout) **comb. n.**

Racheospila rhodonota Prout, 1916: 159. Holotype ♂, PERU: Carabaya, Limbani, c. 2900 m ('9500 ft'), v.1904 (*Ockenden*) (genitalia slide Geom. 15018; BMNH) [examined].

REMARKS. The male genitalia resemble those of *licada*.

DISTRIBUTION. Peru.

Lissochlora rufiguttata (Warren) **comb. n.**

Racheospila rufiguttata Warren, 1900: 139. Holotype ♀, VENEZUELA: Merida (*Briceno*) (genitalia slide Geom. 15612; BMNH) [examined].

REMARKS. The female genitalia are similar to those of the *albociliaria*-group but the male genitalia differ from those of that group.

DISTRIBUTION. Venezuela; Colombia?; Peru?; Bolivia?.

Lissochlora rufipicta (Prout) **comb. n.**

Blechroma rufipicta Prout, 1910: 233. LECTOTYPE ♂, E. PERU: Huancabamba, Cerro del Pasco (genitalia slide Geom. 15608; BMNH), here designated [examined].

Racheospila rufipicta (Prout); Prout, 1932: 34).

REMARKS. *L. rufipicta* is related to *punctiseriata*.

DISTRIBUTION. Peru; Bolivia.

Lissochlora rufoseriata (Prout) **comb. n.**

Racheospila rufoseriata Prout, 1917b: 376. Holotype ♂, NE. PERU: Cerro de Pasco, Huancabamba, c. 2100 m ('6800 ft') (genitalia slide Geom. 14007; BMNH) [examined].

REMARKS. The male genitalia resemble those of *liriata*.

DISTRIBUTION. Peru.

Lissochlora stacta (Prout) **comb. n.**

Racheospila stacta Prout, 1932: 34. Holotype ♂, COLOMBIA: E. Cordillera, Pacho, 2200 m (*Fassl*) (genitalia slide Geom. 15610; BMNH) [examined].

REMARKS. The male genitalia resemble those of *calida*.

DISTRIBUTION. Colombia.

Lissochlora venilineata Warren **comb. rev.**

Lissochlora venilineata Warren, 1907: 205. Holotype ♂, PERU: Carabaya, Limbani, c. 2900 m ('9500 ft'), iv.1904 (*Ockenden*) (BMNH) [examined].

Racheospila venilineata (Warren); Prout, 1932: 32.

DISTRIBUTION. Peru; Bolivia (USNM).

NEMORIA Hübner, 1818

The *pulveraria*-group

Nemoria characta (Prout) **comb. n.**

Dryadopsis characta Prout, 1932: 40. Holotype ♂, E. COLOMBIA: upper ('Ob.') Río Negro, 800 m (*Fassl*) (genitalia slide Geom. 14157; BMNH) [examined].

DISTRIBUTION. Colombia; Bolivia.

Nemoria pulveraria (Schaus) **comb. n.**

Racheospila pulveraria Schaus, 1901: 251. LECTOTYPE ♂, BOLIVIA: Songo (genitalia

slide no. 57,560; [Type No. A12602]; USNM), here designated [examined].

Dryadopsis pulveraria (Schaus); Prout, 1932: 40.

REMARKS. *N. pulveraria* is variable in size.

DISTRIBUTION. French Guiana; Guyana; Colombia; Peru; Bolivia; Brazil.

The *erina*-group

Nemoria parcipuncta (Dognin) **comb. n.**

Blechroma parcipuncta Dognin, 1908b: 264.

LECTOTYPE ♀, FRENCH GUIANA: St Laurent du Maroni (USNM), here designated [examined].

Racheospila parcipuncta (Dognin); Prout, 1932: 29.

DISTRIBUTION. French Guiana; Venezuela; Colombia; Brazil.

REMARKS. This species was described from 3 ♂, 3 ♀, of which all but one are misidentifications of the closely related species *punctilinea*. In order to retain the identity of *parcipuncta* I have selected as lectotype the sole syntype that is not *punctilinea*, even though this was labelled merely as 'cotype' and not as 'type'. The specimen bearing the USNM Type No. 32593 is thus a paralectotype.

Nemoria spatha (Debauche) **comb. n.**

Racheospila spatha Debauche, 1937: 5; fig. 4.

Holotype ♂, BRAZIL: Amazonas, São Paulo de Olivença, Rio Solimoes (Debauche) [not examined].

REMARKS. I have examined a photograph of the paratype (a ♂ bearing the same data as the holotype) which is in the IRSNB, Brussels. Debauche placed this species in the *exertata*-group but, the paratype at any rate, belongs in the *erina*-group and is probably conspecific with *parcipuncta*.

DISTRIBUTION. Literature record: Brazil (Debauche).

Nemoria unipunctata (Prout) **comb. n., stat. rev.**

Racheospila unipunctata Prout, 1912: 107. Holotype ♂, BRAZIL: Rio Grande do Sul (probably Porto Alegre) (genitalia slide Geom. 14197; BMNH) [examined].

Miantonota erina ab. *disjuncta* Warren, 1909: 81. [Unavailable, infrasubspecific name.]

Racheospila disjuncta Prout, 1932: 28. LECTOTYPE ♂, ARGENTINA: Tucuman, 1100 m, i-ii.1905 (Steinbach) (BMNH), here designated [examined]. **Syn. n.**

REMARKS. Prout's description of *disjuncta* was based on Warren's specimens (1 ♂, 1 ♀ 'types') referred to under ab. *disjuncta*; Prout cited *unipunctata* as an aberration or race of *disjuncta*.

DISTRIBUTION. Argentina; Paraguay; Brazil.

The *exertata*-group

Nemoria aturia scotocephala (Prout) **comb. n.**

Racheospila tisstigmara scotocephala Prout, 1916: 163. Holotype ♂, NE. PERU: Huanuco, Cushi, 1900 m (Hoffmanns) (genitalia slide Geom. 14233; BMNH) [examined].

REMARKS. *N. a. scotocephala* appears to be merely a dark geographic variety of *aturia*.

DISTRIBUTION. Colombia; Peru.

Nemoria conflua (Warren) **comb. n.**

Blechroma conflua Warren, 1904b: 502. Holotype ♂, SE. PERU: Carabaya, Santo Domingo, c. 1850 m ('6000 ft'), iv.1902 (Ockenden) (BMNH) [examined].

Racheospila conflua (Warren); Prout, 1932: 35.

REMARKS. *N. conflua* appears to be closely related to *oppleta* and *pulverata* which have a similar wing pattern.

DISTRIBUTION. Peru.

Nemoria conspersa (Warren) **comb. n.**

Blechroma conspersa Warren, 1904b: 502. Holotype ♂, SE. PERU: Carabaya, Santo Domingo, c. 2000 m ('6500 ft'), xii.1902 (Ockenden) (genitalia slide Geom. 15600; BMNH) [examined].

Racheospila conspersa (Warren); Prout, 1932: 40.

DISTRIBUTION. Peru.

Nemoria hypotiches (Prout) **comb. n.**

Racheospila hypotiches Prout, 1932: 35. LECTOTYPE ♂, ECUADOR: Bolivar, Balzapamba, ix.1893-ii.1894 (de Mathan) (genitalia slide Geom. 15690; BMNH), here designated [examined].

DISTRIBUTION. Ecuador.

Nemoria nigricincta nigricincta (Warren) **comb. n.**

Blechroma nigricincta Warren, 1904b: 503. LECTOTYPE ♂, SE. PERU: Carabaya, Santo Domingo, c. 1850 m ('6000 ft'), vi.1902 (Ockenden) (BMNH), here designated [examined]. *Racheospila nigricincta* (Warren); Prout, 1932: 35.

DISTRIBUTION. Peru.

***Nemoria nigricincta fassli* (Prout) comb. n.**

Racheospila nigricincta fassli Prout, 1932: 35.
Holotype ♂, E. COLOMBIA: upper ('Ob.')
Río Negro, 800 m (*Fassl*) (genitalia slide
Geom. 14061; BMNH) [examined].

DISTRIBUTION. Colombia.

***Nemoria nigricincta ligata* (Debauche) comb. n.**

Racheospila nigricinctata [sic] ligata Debauche,
1937: 4; fig. 3. Holotype ♂, BRAZIL: Ama-
zones, São Paulo de Olivença (Rio Solimoes)
(*Debauche*) [not examined].

REMARKS. I have examined a photograph of the
paratype (♂, cited in the original description as
♀) which bears the same data as the holotype
and is in the IRSNB, Brussels.

DISTRIBUTION. Literature record: Brazil
(*Debauche*).

***Nemoria oppleta* (Warren) comb. n.**

Blechroma oppleta Warren, 1907: 201. LECTO-
TYPE ♂, PERU: R. Inambari, La Oroya,
3100ft, ix.1904 (*Ockenden*) (genitalia slide
Geom. 14109; BMNH), here designated
[examined].

Racheospila oppleta (Warren); Prout, 1932: 35.

REMARKS. *B. oppleta* has a similar wing pattern
to *conflua* and *pulverata*.

DISTRIBUTION. Colombia; Peru.

***Nemoria penthica* (Prout) comb. n.**

Racheospila penthica Prout, 1917a: 115. Lecto-
type ♂, E. PERU: Huancabamba, Cerro de
Pasco, c. 2100 m ('6800 ft') (BMNH), desig-
nated [as 'type'] by Prout, 1932: 35 [exam-
ined].

DISTRIBUTION. Peru.

***Nemoria pulverata* (Dognin) comb. n.**

Blechroma pulverata Dognin, 1914: 381. Holo-
type ♂, E. COLOMBIA: Medina, 500 m
(*Fassl*) (Type No. 32596; USNM) [examined].
Racheospila pulverata (Dognin); Prout, 1932: 35.

REMARKS. This species has a similar wing pat-
tern to *conflua* and *oppleta*.

DISTRIBUTION. Colombia; Ecuador.

***Nemoria spurca* Herbulot**

Nemoria spurca Herbulot, 1982: 59; fig. 3; pl. 3,
fig. 13. Holotype ♂, ECUADOR: 77 km on
old route from Quito to Santo Domingo de los
Colorados, 1620 m, 15–16.ii.1975 (*Herbulot*)
(HERB) [not examined].

REMARKS. Herbulot rightly places this species
near *conspersa*.

DISTRIBUTION. Ecuador.

The *cosmeta*-group***Nemoria imitans* (Warren) comb. n., sp. rev.**

Miantonota imitans Warren, 1907: 206. Holotype
♂, SE. PERU: Carabaya, Tinguri, c. 1050 m
(‘3400 ft’), viii.1904 (*Ockenden*) (genitalia
slide Geom. 13316; BMNH) [examined].
Miantonota imitans ab. *versiplaga* Dognin,
1911b: 161. [Infrasubspecific name.]

REMARKS. *N. imitans* was incorrectly cited as a
synonym of *integra* by Prout (1932: 28). One of
Dognin’s two specimens of *M. i.* ab. *versiplaga* is
not conspecific with *imitans*; the identity of the
other specimen is unknown.

DISTRIBUTION. Venezuela; Colombia; Ecuador;
Peru; Bolivia.

***Nemoria integra* (Warren) comb. n.**

Miantonota integra Warren, 1897: 425. LECTO-
TYPE ♀, BRAZIL: Petropolis (genitalia slide
Geom. 14271; BMNH), here designated
[examined].

Racheospila integra (Warren); Prout, 1932: 28.

REMARKS. Described from an unspecified num-
ber of ♂, ♀, from Petropolis, Novo Friburgo
and elsewhere (unspecified).

DISTRIBUTION. Paraguay?; Brazil. Literature
records by Prout (1932: 28) from Colombia (as
ab. *versiplaga*, see *imitans*) and from Mexico are
based on misidentifications.

Other species in the genus***Nemoria acora* (Dognin) comb. n.**

Geometra acora Dognin, 1898: 215. LECTO-
TYPE ♂, ECUADOR: Loja area, 1891 (Type
No. 32574; USNM), here designated [exam-
ined].

Racheospila acora (Dognin); Prout, 1932: 29.

DISTRIBUTION. Ecuador.

***Nemoria albilineata* (Warren) comb. n.**

Lissochlora albilineata Warren, 1909: 79. Holo-
type ♀, PERU: Carabaya, Limbani, c. 2900 m
(‘9500 ft’), v.1904 (*Ockenden*) (BMNH)
[examined].

Racheospila albilineata (Warren); Prout, 1932:
32.

REMARKS. The generic placement of *albilineata*
is uncertain.

DISTRIBUTION. Peru.

Nemoria anchistropa (Prout) **comb. n.**

Racheospila anchistropa Prout, 1932: 28. Holotype, BRAZIL: near Santarem, Taperinha, 21–23.viii.1927 (Zerny) (NM) [not examined].

DISTRIBUTION. Literature record: Brazil (Prout).

Nemoria antipala (Prout) **comb. n.**

Racheospila antipala Prout, 1932: 27. Holotype ♂, SE. PERU: Carabaya, La Oroya, Río Inambari, c. 950 m ('3100 ft'), xii.1905 (*Ockenden*) (genitalia slide Geom. 13981; BMNH) [examined].

Racheospila antipala purifimbria Prout, 1932: 27. Holotype ♂, French Guiana: St Jean du Maroni (genitalia slide Geom. 13982; BMNH) [examined]. **Syn. n.**

DISTRIBUTION. French Guiana; Peru.

Nemoria capys (Druce)

Racheospila capys Druce, 1892: 90. Holotype ♂, MEXICO: Las Vigas (coll. Schaus) (Type No. 17516; USNM) [examined].

Nemoria capys (Druce); Prout, 1912: 112; 1932: 22.

DISTRIBUTION. Mexico.

Nemoria capysoides (Schaus)

Racheospila capysoides Schaus, 1901: 251. LECTOTYPE ♂, MEXICO: Jalapa (Type No. 11889; USNM), here designated [examined].

Nemoria capysoides (Schaus); Delfín-González & Beutelspacher, 1986b: 427).

DISTRIBUTION. Mexico.

Nemoria cara (Dyar) **comb. n.**

Racheospila cara Dyar, 1918: 362. Holotype ♂, MEXICO: Zacualpan, iii.1915 (*Müller*) (genitalia slide no. 57,562; Type No. 21295; USNM) [examined].

REMARKS. *N. cara* is closely related to *mustela* (Dyar, 1918: 363); they may be synonymous.

DISTRIBUTION. Mexico.

Nemoria carbina (Druce) **comb. n.**

Geometra carbina Druce, 1892: 84. Holotype ♀, MEXICO: Las Vigas (coll. Schaus) (Type No. 33214; USNM) [examined].

Racheospila carbina (Druce); Prout, 1932: 28.

DISTRIBUTION. Mexico.

Nemoria consimilis (Warren) **comb. n.**

Miantonota consimilis Warren, 1909: 81. LECTOTYPE ♂, PERU: Carabaya, R. Inambari, La Oroya, c. 950 m ('3100 ft'), ix.1904 (*Ock-*

enden) (genitalia slide Geom. 13425; BMNH), here designated [examined].

Racheospila consimilis (Warren); Prout, 1932: 28.

REMARKS. *N. consimilis* resembles *defectiva* in external features and male genitalia.

DISTRIBUTION. Peru; Bolivia; Brazil.

Nemoria delicataria Möschler

Nemoria delicataria Möschler, 1881: 402. Holotype ♀, SURINAM: Paramaribo (genitalia slide no. LMP 242; MNHU) [examined].

DISTRIBUTION. Surinam.

Nemoria dentilinea paurocaula (Prout) **comb. n.**

Racheospila dentilinea paurocaula Prout, 1932: 27. LECTOTYPE ♂, ARGENTINA: Misiones, ii (*Wagner*) 'Missions' (genitalia slide Geom. 13302; BMNH), here designated [examined].

REMARKS. *R. d. paurocaula* and *tenuilinea* may be conspecific but both may be distinct from *dentilinea*.

DISTRIBUTION. Argentina; Paraguay; Brazil?.

Nemoria dentilinea tenuilinea (Kaye) **comb. n.**

Oenospila tenuilinea Kaye, 1901: 147; pl. 6, fig. 16. LECTOTYPE ♀, TRINIDAD: Tabaquite (*Kaye*) (genitalia slide Geom. 15577; BMNH), here designated [examined].

Racheospila dentilinea tenuilinea (Kaye); Prout, 1932: 27.

DISTRIBUTION. French Guiana?; Guyana; Trinidad.

Nemoria fontalis (Warren) **comb. n.**

Racheospila fontalis Warren, 1909: 86. Holotype ♂, BRAZIL: UA, Fonte Boa, v.1906 (*Klages*) (genitalia slide Geom. 13293; BMNH) [examined].

DISTRIBUTION. Brazil. Literature records by Prout (1932: 27) from Costa Rica and Peru are probably based on misidentifications.

Nemoria gortaria (Schaus) **comb. n.**

Racheospila gortaria Schaus, 1901: 252. LECTOTYPE ♀, BRAZIL: Parana, Castro (genitalia slide no. LMP 236; Type No. 11893; USNM), here designated [examined].

DISTRIBUTION. Paraguay?; Brazil.

Nemoria haematospila (Prout) **comb. n.**

Racheospila haematospila Prout, 1912: 107. Holotype ♂, BRAZIL: Preto (BMNH) [examined].

DISTRIBUTION. Brazil.

Nemoria inaequalis (Prout) **comb. n.**

Racheospila inaequalis Prout, 1917a: 116. Lectotype ♂, SE. PERU: Carabaya, Santo Domingo, c. 1850 m ('6000 ft'), xi.1904 (*Ockenden*) (genitalia slide Geom. 15613; BMNH), designated [as 'type'] by Prout, 1932: 31 [examined].

DISTRIBUTION. Peru.

Nemoria incognita (Warren) **comb. n.**

Lissochlora incognita Warren, 1900: 135. Holotype ♀, S. AMERICA? (BMNH) [examined]. *Racheospila incognita* (Warren); Prout, 1932: 29.

REMARKS. The generic placement of the aptly named *incognita* is uncertain; it may belong in *Lissochlora*. The unique specimen has a glued abdomen that does not seem likely to belong to this species.

DISTRIBUTION. Unknown.

Nemoria latimarginaria (Maassen) **comb. n.**

Phorodesma latimarginaria Maassen, 1890: 75, 160; pl. 8, fig. 12. Holotype ♂, PERU: Pucatambo to Río negro, 860–1470m, vi.1868–1877 (*Stübel*) (MNHU) [examined].

Racheospila latimarginaria (Maassen); Prout, 1932: 37.

DISTRIBUTION. Peru.

Nemoria modesta (Dognin) **comb. n.**

Miantonota modesta Dognin, 1911a: 22. Holotype ♂, MEXICO: [Veracruz,] Jalapa (Type No. 33213; USNM) [examined].

Racheospila modesta (Dognin); Prout, 1932: 25.

REMARKS. This species resembles *zelotes* (a North American species).

DISTRIBUTION. Mexico; Guatemala.

Nemoria morbilliata (Felder & Rogenhofer) **comb. n.**

Racheospila morbilliata Felder & Rogenhofer, 1875: pl. 127, fig. 16. Lectotype ♂, BRAZIL (BMNH), designated as ['the type'] by Prout, 1932: 40 [examined].

Dryadopsis morbilliata (Felder & Rogenhofer); Prout, 1932: 40.

REMARKS. An abdomen belonging to a member of another subfamily had been glued to the lectotype.

DISTRIBUTION. Brazil.

Nemoria mustela (Druce)

Racheospila mustela Druce, 1892: 90. Holotype

♂, MEXICO: Orizaba, iii. 1888 (*Elwes*) (genitalia slide Geom. 14094; BMNH) [examined].

Nemoria mustela (Druce); Delfín-González & Beutelspacher, 1986a: 180.

DISTRIBUTION. Mexico. The literature record from Costa Rica (Prout, 1932: 36) is erroneous and probably refers to *vermiculata*.

Nemoria nigrisquama (Dognin) **comb. n.**

Miantonota nigrisquama Dognin, 1904: 119. Holotype ♂, SE. PERU: Santo Domingo, Carabaya (Type No. 32608; USNM) [examined].

Racheospila nigrisquama (Dognin); Prout, 1932: 28.

REMARKS. The generic placement of *nigrisquama* is uncertain and it may belong in *Lissochlora*.

DISTRIBUTION. Colombia?; Peru; Bolivia?.

Nemoria parvipuncta (Warren) **comb. n.**

Racheospila parvipuncta Warren, 1900: 138. LECTOTYPE ♀, GUYANA: Río Demerara, E. coast (BMNH), here designated [examined].

DISTRIBUTION. French Guiana, Guyana.

Nemoria peruviana (Prout) **comb. n.; stat. n.**

Racheospila cosmata peruviana Prout, 1916: 162. Holotype ♂, PERU: Carabaya, Santo Domingo, c. 1850–2000 m ('6000–6500 ft'), iii.1902 (*Ockenden*) (genitalia slide Geom. 13319; BMNH) [examined].

REMARKS. This species resembles *acutularia* and *remota* in the male genitalia.

DISTRIBUTION. Colombia?; Peru; Bolivia?.

Nemoria prava (Prout) **comb. n.**

Racheospila prava Prout, 1932: 31. Holotype ♂, BOLIVIA: Prov. del Sara, Dep. Sta. Cruz, 450 m, i (*Steinbach*) (BMNH) [examined].

DISTRIBUTION. Bolivia; Brazil.

Nemoria roseilinearia (Dognin) **comb. n.**

Racheospila roseilinearia Dognin, 1892: 206. LECTOTYPE ♂, ECUADOR: Loja area, 1891 [1890 on specimen label] (Type No. 32573; USNM), here designated [examined].

DISTRIBUTION. Ecuador; Peru; Bolivia (CMNH).

Nemoria sanguinipunctata (Dognin) **comb. n.**

Lissochlora sanguinipunctata Dognin, 1906a: 204. Holotype ♀, ARGENTINA: Tucuman (Type No. 33212; USNM) [examined].

Racheospila sanguinipunctata (Dognin); Prout, 1932: 32.

REMARKS. The generic placement of *sanguinipunctata* is uncertain and it may belong in *Lissochlora*.

DISTRIBUTION. Argentina.

Nemoria sellata (Warren) **comb. n.**

Miantonota sellata Warren, 1907: 206. LECTOTYPE ♂, SE. PERU: R. Inambari, La Oroya, c. 950 m ('3100 ft'), iii.1905 (*Ockenden*) (genitalia slide Geom. 13477; BMNH), here designated [examined].

Racheospila sellata (Warren); Prout, 1932: 28.

DISTRIBUTION. Colombia?; Peru.

Nemoria sigillaria Guenée **comb. rev.**

Nemoria sigillaria Guenée, 1857: 375. Holotype ♂, URUGUAY: Montevideo (Coll. Guenée) (BMNH) [examined].

Racheospila degener Prout, 1916: 163. LECTOTYPE ♂, ARGENTINA: Entre Rios, near Uruguay frontier, La Soledad, 14, 30.xii.1909 (*Britton*) (BMNH), here designated [examined]. [Synonymy cited by Prout, 1932: 25.].

Racheospila sigillaria (Guenée); Prout, 1932: 25.

DISTRIBUTION. Argentina; Uruguay. The literature record by Delfín-González & Beutelspacher, (1986b: 426) from Mexico is highly dubious.

Nemoria sordifrons (Prout) **comb. n.**

Racheospila sordifrons Prout, 1932: 26. Holotype ♂, BRAZIL: Sao Paulo, Alto da Serra, iv.1923 (*Spitz*) (BMNH) [examined].

DISTRIBUTION. Brazil.

Nemoria tarachodes (Dyar) **comb. n.**

Racheospila tarachodes Dyar, 1922: 14. Holotype ♂, MEXICO: near Mexico City, vi.1921 (*Müller*) (Type No. 24941; USNM) [examined].

Nemoria coruscula Ferguson, 1969: 37 [non binominal], 55. Holotype ♂, MEXICO: near Mexico City, vi.1921 (*Müller*) (Type No. 24941; USNM) [examined]. **Syn. n.**

REMARKS. The holotype of *tarachodes*, identifiable by its Type No. 24941, is referred to by the manuscript name of *Racheospila caruscula* Dyar in the USNM type collection and Ferguson's references to *coruscula* are based on that manuscript name and, it is inferred, on that holotype. *N. tarachodes* resembles *mutaticolor* (a species in Nearctic Mexico and Arizona).

DISTRIBUTION. Mexico.

Nemoria thelys (Prout) **comb. n.**

Racheospila thelys Prout, 1932: 32. Holotype ♂, GUATEMALA: Quiche Mountains, c. 2700–3100 m ('9000–10000 ft') [7–9000 ft on label] (*Champion*) (genitalia slide Geom. 13816; BMNH) [examined].

DISTRIBUTION. Guatemala.

Nemoria torsilinea (Warren)

Mixocera torsilinea Warren, 1905a: 44. Holotype ♂, Paraguay: Palino cué, ii (*Montforts*) (genitalia slide Geom. 15607; BMNH) [examined].

Racheospila torsilinea (Warren); Prout, 1932: 34.

DISTRIBUTION. Paraguay.

Nemoria viridicincta (Schaus) **comb. n.**

Racheospila viridicincta Schaus, 1901: 252. LECTOTYPE ♀, BRAZIL: Parana, Castro (genitalia slide no. 57,590; Type No. 11894; USNM), here designated [examined].

DISTRIBUTION. Brazil.

Nemoria viridiscata (Dognin) **comb. n.**

Racheospila viridiscata Dognin, 1923: 16. Holotype ♀, VENEZUELA: Merida (genitalia slide no. 57,589; Type No. 32606; USNM) [examined].

DISTRIBUTION. Venezuela.

Nemoria xaliria (Dognin) **comb. n.**

Geometra xaliria Dognin, 1898: 212. LECTOTYPE ♂, ECUADOR: Loja area, 1888 (genitalia slide no. 57,566; Type No. 32610; USNM), here designated [examined].

Racheospila xaliria (Dognin); Prout, 1932: 27.

DISTRIBUTION. Ecuador. Literature records by Prout (1932: 28) from French Guiana and Brazil are probably based on misidentifications.

Nemoria zernyi (Prout) **comb. n.**

Racheospila zernyi Prout, 1932: 36. Holotype ♂, BRAZIL: Sao Paulo, Alto da Serra, 29–30.x.1927 (*Zerny*) (NM) [not examined].

DISTRIBUTION. Brazil.

SPECIES TRANSFERRED TO *SYNCHLORA*

The following Neotropical species, including some from Costa Rica, were cited in *Racheospila*, mostly by Prout (1932: 38–39), and are here transferred to *Synchlora*.

Synchlora amplimaculata (Herbulot) **comb. n.**

Racheospila amplimaculata Herbulot, 1991: 108. Holotype ♂, ECUADOR: 77 km from Quito to Santo Domingo (old route), 1620 m, 15–16.i.1975 (*Herbulot*) (HERB) [not examined].

REMARKS. Related to *astraeoides* (Herbulot, 1991: 108). DISTRIBUTION. Ecuador.

***Synchlora atrapes* (Druce) comb. n.**

Racheospila atrapes Druce, 1892: 91. Holotype ♀, PANAMA: Chiriqui (*Ribbe*) (MNHU) [examined].

DISTRIBUTION. Honduras?; Panama. Literature record: Mexico (Delfín-González & Beutelspacher, 1986b: 426) is more likely to be based on *atrapes trujilloi*.

***Synchlora atrapes trujilloi* (Prout) comb. n.**

Racheospila atrapes trujilloi Prout, 1932: 39. Holotype ♀, MEXICO: Jalapa (*Trujillo*) (BMNH) [examined].

DISTRIBUTION. Mexico.

***Synchlora bidentifera* (Warren) comb. n.**

Racheospila bidentifera Warren, 1901: 449. Holotype ♂, COLOMBIA (BMNH) [examined].

DISTRIBUTION. Colombia; Ecuador; Peru.

***Synchlora concinnaria* (Schaus) comb. n.**

Racheospila concinnaria Schaus, 1912: 290. LECTOTYPE ♂, COSTA RICA: Sixaola R., iii (genitalia slide no. 57,593; Type No. 17729; USNM), here designated [examined].

DISTRIBUTION. Mexico?; Guatemala?; Honduras?; Belize?; Costa Rica.

***Synchlora decorata* (Warren) comb. n.**

Racheospila decorata Warren, 1901: 449. Holotype ♂, ECUADOR: Chimbo, c. 310 m ('1000 ft'), vii.1897 (*Rosenberg*) (BMNH) [examined].

DISTRIBUTION. Colombia?; Ecuador; Peru? Literature record: Mexico (Delfín-González & Beutelspacher, 1986b: 426) requires confirmation.

***Synchlora dependens dependens* (Warren) comb. n.**

Racheospila dependens Warren, 1904a: 25. LECTOTYPE ♂, SE. PERU: Carabaya, Santo Domingo, c. 1850 m ('6000 ft'), xi.1901 (*Ockenden*) (BMNH), here designated [examined].

DISTRIBUTION. Peru; Bolivia?.

***Synchlora dependens independens* (Prout) comb. n.**

Racheospila dependens independens Prout, 1916: 166. Holotype ♂, PERU: Carabaya,

Oconeque, c. 2150 m ('7000 ft'), vii.1904 (*Ockenden*) (BMNH) [examined].

DISTRIBUTION. Peru.

***Synchlora dependens megastigma* (Warren) comb. n.**

Racheospila megastigma Warren, 1905a: 45. Holotype ♀, COSTA RICA: Tuis (BMNH) [examined].

DISTRIBUTION. Costa Rica.

***Synchlora dependens tumefacta* (Prout) comb. n.**

Racheospila tumefacta Prout, 1910: 236. Holotype ♂, COLOMBIA: Torne, viii.1907 (BMNH) [examined].

DISTRIBUTION. Panama?; Venezuela; Colombia; Ecuador?.

***Synchlora despicata* (Prout) comb. n.**

Racheospila despicata Prout, 1932: 27. Holotype ♂, FRENCH GUIANA: St Jean du Maroni (genitalia slide Geom. 13984; BMNH) [examined].

REMARKS. This species is anomalous in many respects but it is more suitably placed in *Synchlora* than in any other existing genus. The male socii are developed as in *Synchlora* although a very short uncus is also present. The gnathos is peculiar in having two prongs instead of the usual single hook. The notched saccus and papillate juxta are reminiscent of *Nemoria*; however, a structure which I initially thought to be a basal process of the valva does not appear to be homologous with that feature of *Nemoria*. Although this structure joins the base of the valva it does not arise from the costa and it appears to be attached to the tegumen. The male antennae have short branches, unlike any other species of *Synchlora*.

DISTRIBUTION. French Guiana; Brazil?.

***Synchlora ephippiaria* (Möschler) comb. n.**

Cambogia ephippiaria Möschler, 1886: 68. LECTOTYPE ♂, JAMAICA (MNHU), here designated [examined].

DISTRIBUTION. Jamaica.

***Synchlora expulsata atrapoides* (Prout) comb. n.**

Racheospila expulsata atrapoides Prout, 1932: 39. Holotype ♂, MEXICO: [Veracruz,] Orizaba [stated as Jalapa], iv.1896 (*Schaus*) (genitalia slide Geom. 13306; BMNH) [examined].

REMARKS. The specimen labelled as 'type', in the BMNH collection, seems likely to be the holotype even though it is from Orizaba and not

from Jalapa; no specimens from Jalapa were traced.

DISTRIBUTION. Mexico; Guatemala?; Honduras?; Costa Rica?.

Synchlora isolata (Warren) **comb. n.**

Racheospila isolata Warren, 1900: 138. LECTOTYPE ♀, GRENADA (BMNH), here designated [examined].

DISTRIBUTION. Puerto Rico?; Guadeloupe?; St Vincent?; Grenada.

Synchlora leucoceraria (Snellen) **comb. n.**

Geometra leucoceraria Snellen, 1874: 41. Syn-types 2 ♂, COLOMBIA: Bogota, 6.vi. (RNHL) [photograph of one syntype examined].

DISTRIBUTION. Colombia.

Synchlora magnaria (Bastelberger) **comb. n.**

Racheospila magnaria Bastelberger, 1911b: 149. Lectotype ♀, MEXICO: [Veracruz,] Jalapa (SMF), designated by Prout, 1932: 39 [as 'the type'] [transparency examined].

REMARKS. Closely related to or conspecific with *atrappes trujilloi*; Prout stated in his description of *magnaria* that it might prove to be a giant form of that.

DISTRIBUTION. Guatemala?; Colombia?. Literature record: Mexico (Bastelberger, 1911: 149).

Synchlora merlinaria (Schaus) **comb. n.**

Racheospila merlinaria Schaus, 1940: 306. Holotype ♂, PUERTO RICO: Vieques I., Puerto Real (Cornell) [examined].

REMARKS. Schaus (1940: 306) cites *merlinaria* as near *herbaria* which was placed in *Racheospila* at that time but now belongs in *Synchlora*.

DISTRIBUTION. Puerto Rico.

Synchlora pomposa (Dognin) **comb. n.**

Racheospila pomposa Dognin, 1898: 217. LECTOTYPE ♂, ECUADOR: Loja area, 1892 (genitalia slide no. 57,577; Type No. 32613; USNM), here designated [examined].

Racheospila diaphana Warren, 1901: 450. LECTOTYPE ♀, PERU: Marca, 3000 m [published as ft], 22.xii.1899 (*Simons*) (BMNH), here designated [examined]. [Synonymized by Prout, 1916: 166.].

DISTRIBUTION. Ecuador; Peru. Literature record: Mexico (Delfin-González & Beutelspacher, 1986b: 426, as *diaphana*).

Synchlora rufilineata rufilineata (Warren) **comb. n.**

Aplodes rufilineata Warren, 1897: 423. Holotype ♂, SURINAM: Berg-en-Daal, v.1892 (*Ellacombe*) (genitalia slide Geom. 13434; BMNH) [examined].

Racheospila undulosa Kaye, 1901: 148; pl. 6, fig. 23. LECTOTYPE ♂, TRINIDAD: Tabaquite (Kaye) (BMNH), here designated [examined]. [Synonymized by Prout, 1912: 110.].

DISTRIBUTION. French Guiana?; Surinam; Guyana?; Trinidad; Venezuela?; Colombia?; Bolivia?; Paraguay?; Brazil?. Literature record: Mexico (Delfin-González & Beutelspacher, 1986b: 426) requires confirmation.

Synchlora rufilineata albimargo (Prout) **comb. n.**

Racheospila rufilineata albimargo Prout, 1932: 39. LECTOTYPE ♂, COLOMBIA: Muzo, 400–800 m (*Fassl*) (genitalia slide Geom. 13433; BMNH), here designated [examined].

DISTRIBUTION. Colombia.

Synchlora superaddita (Prout) **comb. n.**

Racheospila superaddita Prout, 1913a: 416. Holotype ♂, W. COLOMBIA: Jimenez, c. 500 m ('1600 ft'), vii.1907 (genitalia slide Geom. 13432; BMNH) [examined].

DISTRIBUTION. Mexico?; Guatemala?; French Guiana?; Surinam?; Guyana?; Trinidad?; Colombia; Ecuador?; Peru?; Bolivia?; Brazil?.

Synchlora suppomposa (Prout) **comb. n.**

Racheospila suppomposa Prout, 1916: 165. LECTOTYPE ♀ [cited as ♂], ARGENTINA: Tucuman, 1100 m, i–ii.1905 (*Steinbach*) (BMNH), here designated [examined].

REMARKS. Described from 3 specimens cited as ♂; I have traced no male types but have examined 1 ♀ labelled as 'type'.

DISTRIBUTION. Argentina.

Synchlora tenuimargo tenuimargo (Warren) **comb. n.**

Racheospila tenuimargo Warren, 1905b: 319. Lectotype ♂, BRAZIL: Organ Mts, near Tijuco (BMNH), designated [as 'the type'] by Prout, 1932: 39 [examined].

DISTRIBUTION. Mexico?; Guyana?; Trinidad?; Venezuela?; Colombia?; Argentina?; Brazil. Literature record: U.S.A. (Kimball, 1965: 162).

Synchlora tenuimargo lineimargo (Prout) **comb. n.**

Racheospila tenuimargo lineimargo Prout, 1932: 39. Holotype ♂, BRAZIL: Sao Paulo (genita-

lia slide Geom. 13263; BMNH) [examined].

DISTRIBUTION. Mexico?; Costa Rica?; French Guiana?; Venezuela?; Colombia?; Bolivia?; Brazil.

Synchlora venustula (Dognin) comb. n.

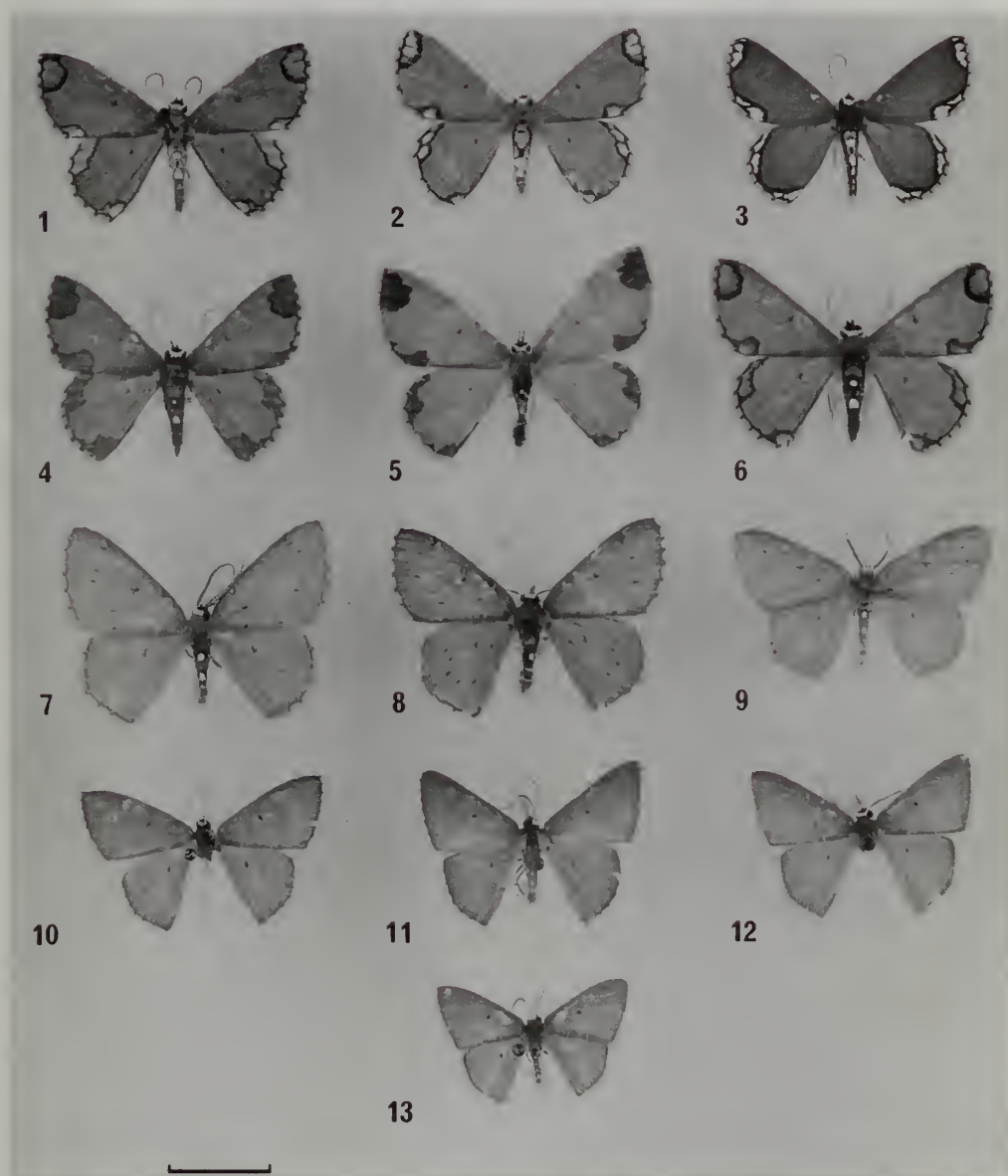
Racheospila venustula Dognin, 1910: 19. Holotype ♂, ECUADOR: near Loja, El Monje, 1893 (Type No. 32611; USNM) [examined].

DISTRIBUTION. French Guiana?; Trinidad; Venezuela?; Colombia?; Ecuador; Peru?.

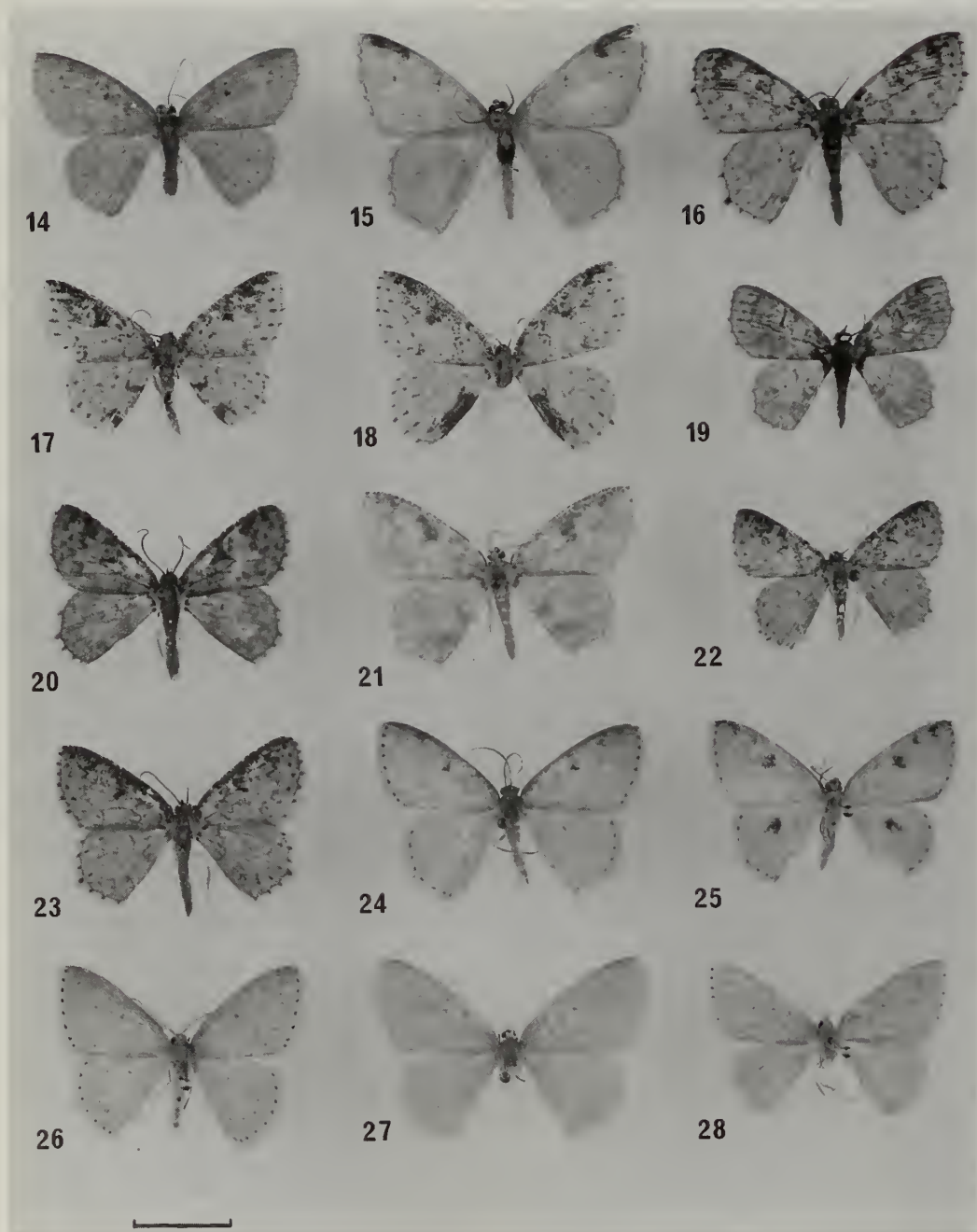
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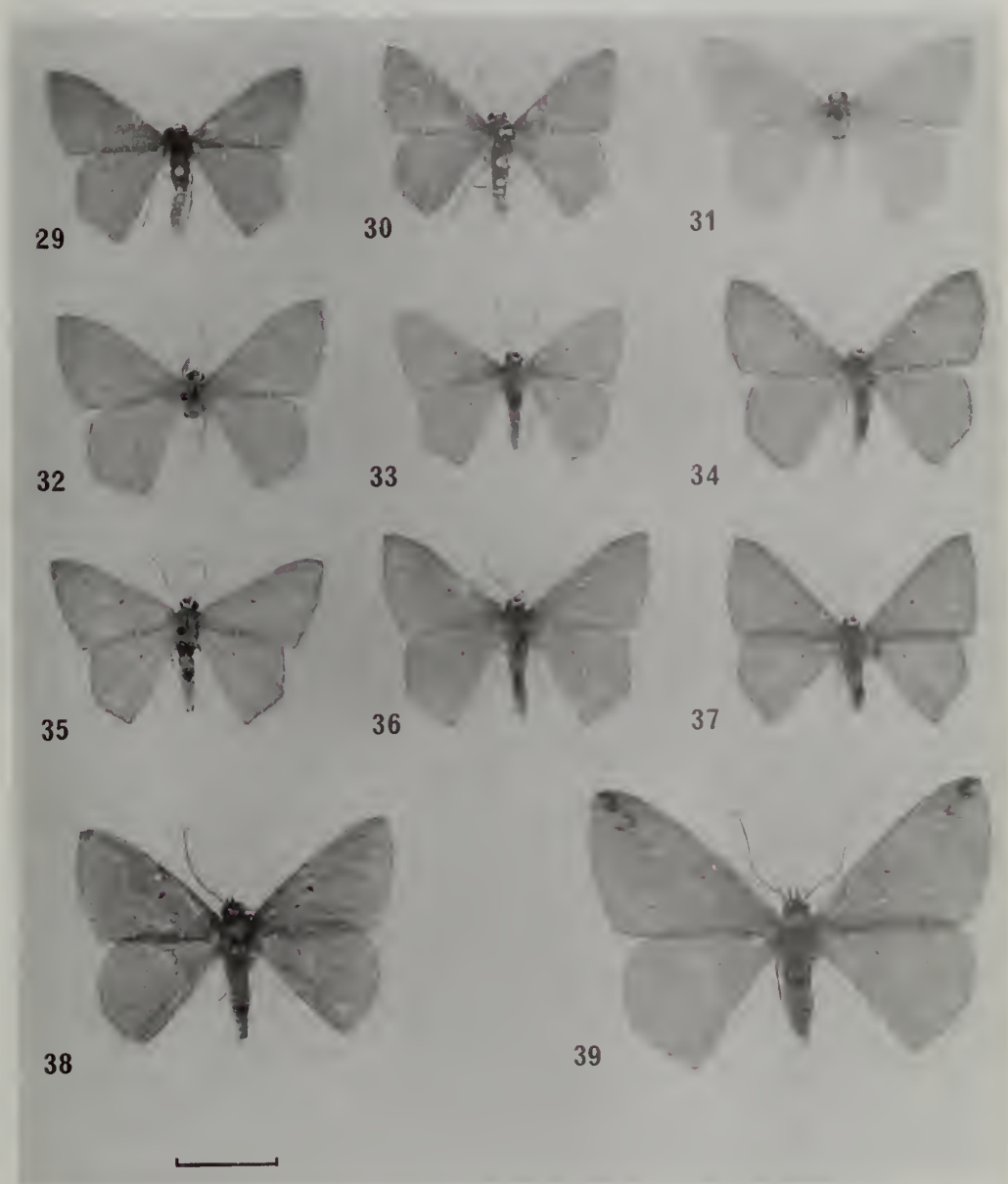
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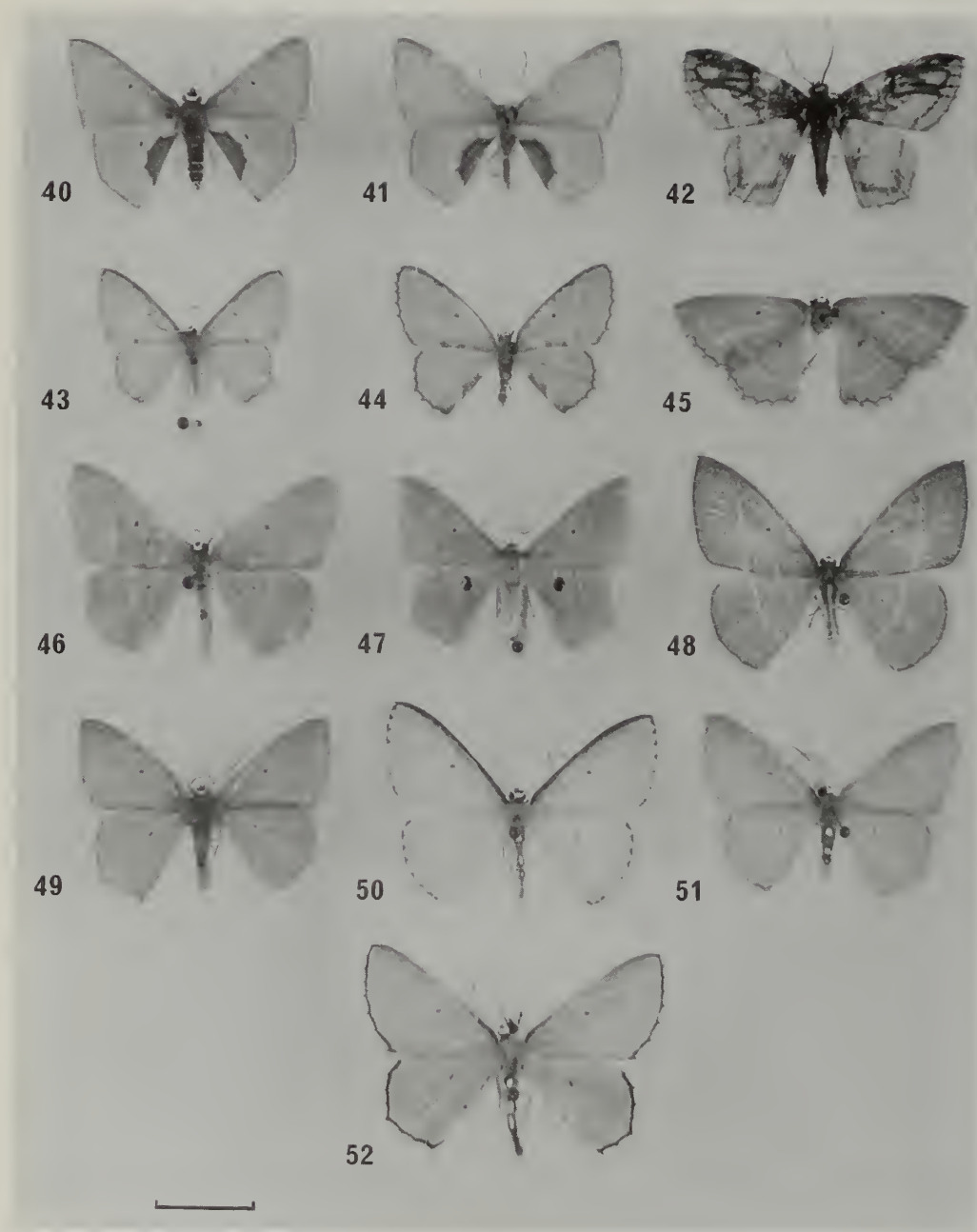
Figs 1–13 *Chavarriella* and *Lissochlora* species. 1, *Ch. fallax* (typical form: Peru). 2, *C. fallax* (typical form). 3, *C. fallax* (narrow blotched form). 4, *C. semiornata*. 5, *C. semiornata*, ♀. 6, *C. porcius*. 7, *L. albociliaria*. 8, *L. manostigma*, ♀. 9, *L. inconspicua*. 10, *L. daniloi*, ♀. 11, *L. freddyi*. 12, *L. latuta*. 13, *L. ronaldi*. Moths are Costa Rican males unless stated otherwise. Scale line = 10 mm.



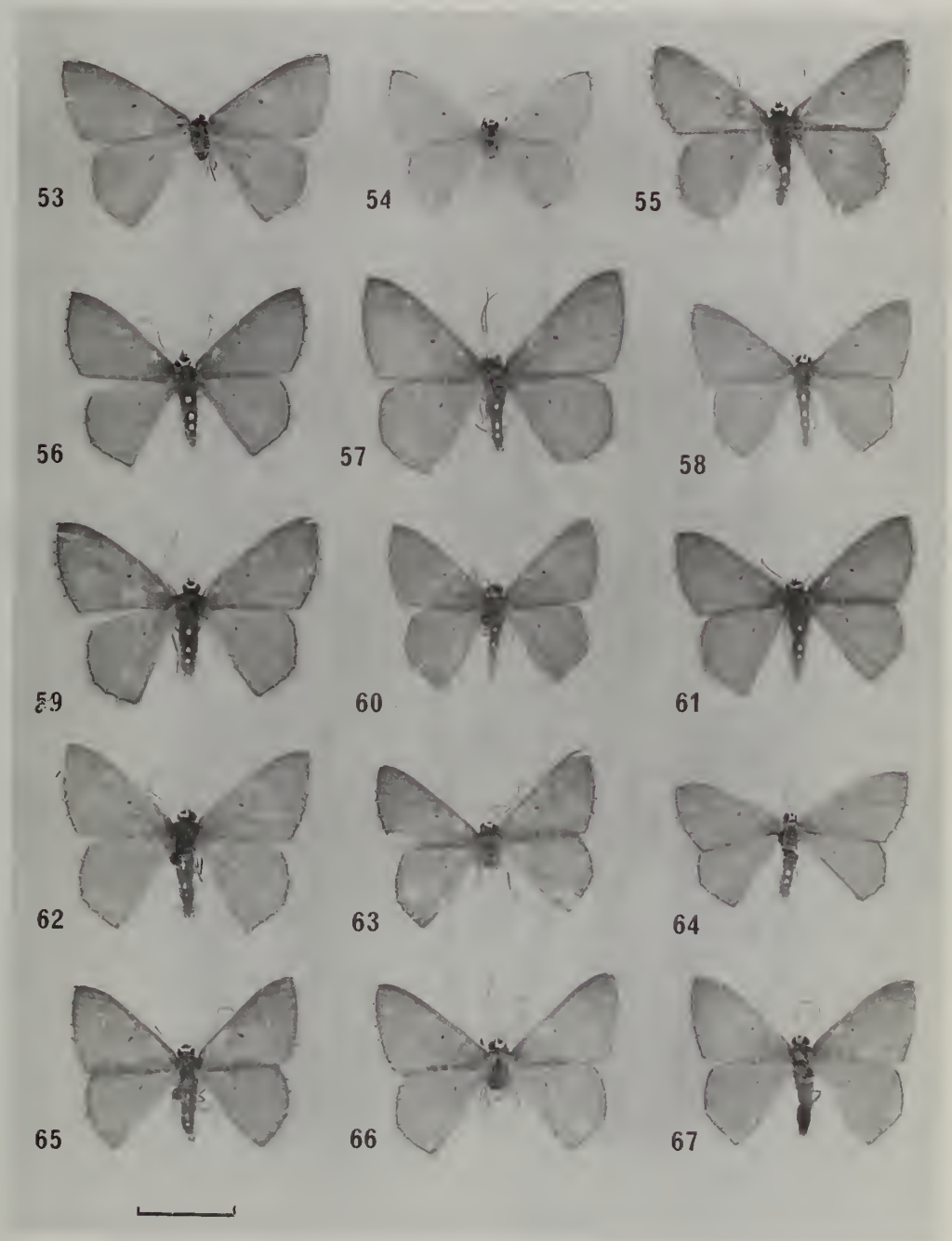
Figs 14–28 *Nemoria* species. 14, *N. aturia aturia*. 15, *N. elbae*. 16, *N. scriptaria*. 17, *N. eugeniae*. 18, *N. eugeniae*. 19, *N. hazelae*. 20, *N. anae*. 21, *N. epaphras*. 22, *N. adjunctaria*. 23, *N. tickelli*. 24, *N. saryae*. 25, *N. strigaria* (blotched form). 26, *N. strigaria* (speckled form). 27, *N. strigaria* (typical form), ♀. 28, *N. duniae*. Moths are Costa Rican males unless stated otherwise. Scale line = 10 mm.



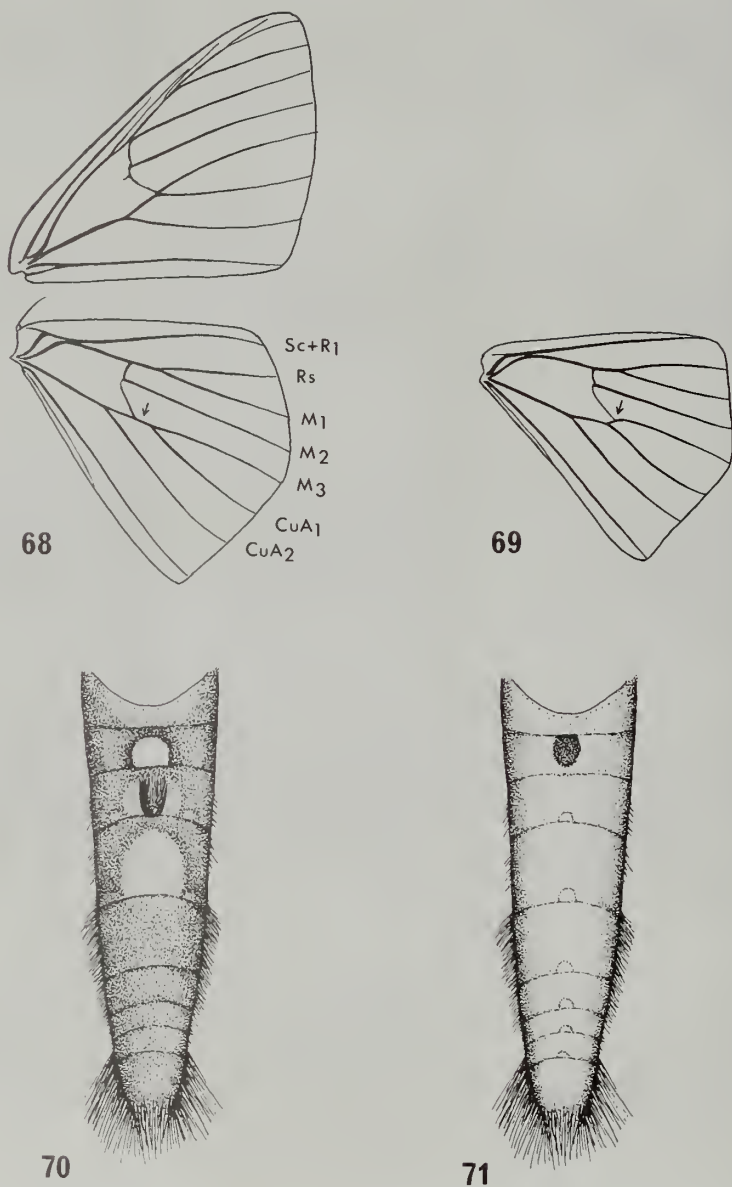
Figs 29–39 *Nemoria* species. 29, *N. marielosae*. 30, *N. lorenae*. 31, *N. sarukhani* (Mexico). 32, *N. cosmeta* (Mexico). 33, *N. rectilinea*. 34, *N. karlae*. 35, *N. carolinae* (Trinidad). 36, *N. pacificaria*. 37, *N. tutala*, ♀. 38, *N. punctilinea*. 39, *N. erina*. Moths are Costa Rican males unless stated otherwise. Scale line = 10 mm.



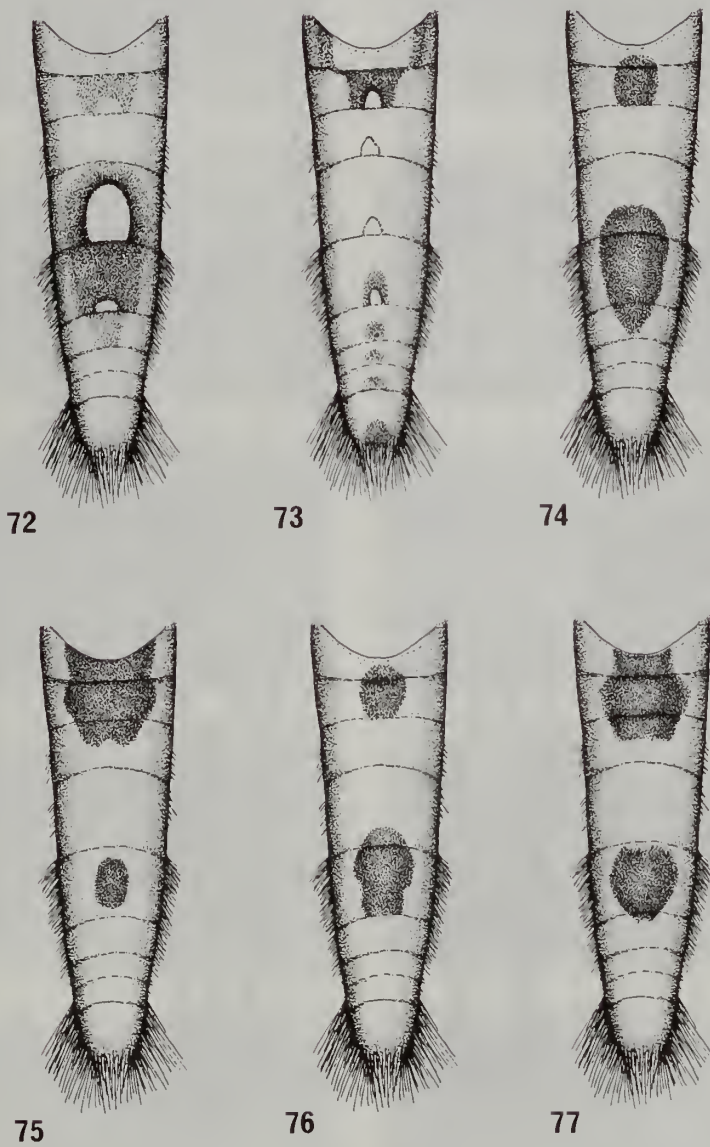
Figs 40–52 *Nemoria* species. 40, *N. astraea*. 41, *N. interlucens*. 42, *N. ozalea*. 43, *N. vermiculata*. 44, *N. vermiculata*, ♀. 45, *N. rosae*, ♀. 46, *N. gerardinae*. 47, *N. pescadora*. 48, *N. dorsilinea*. 49, *N. remota*. 50, *N. vinocincta*. 51, *N. vinocincta*. 52, *N. winniae*. Moths are Costa Rican males unless stated otherwise. Scale line = 10 mm.



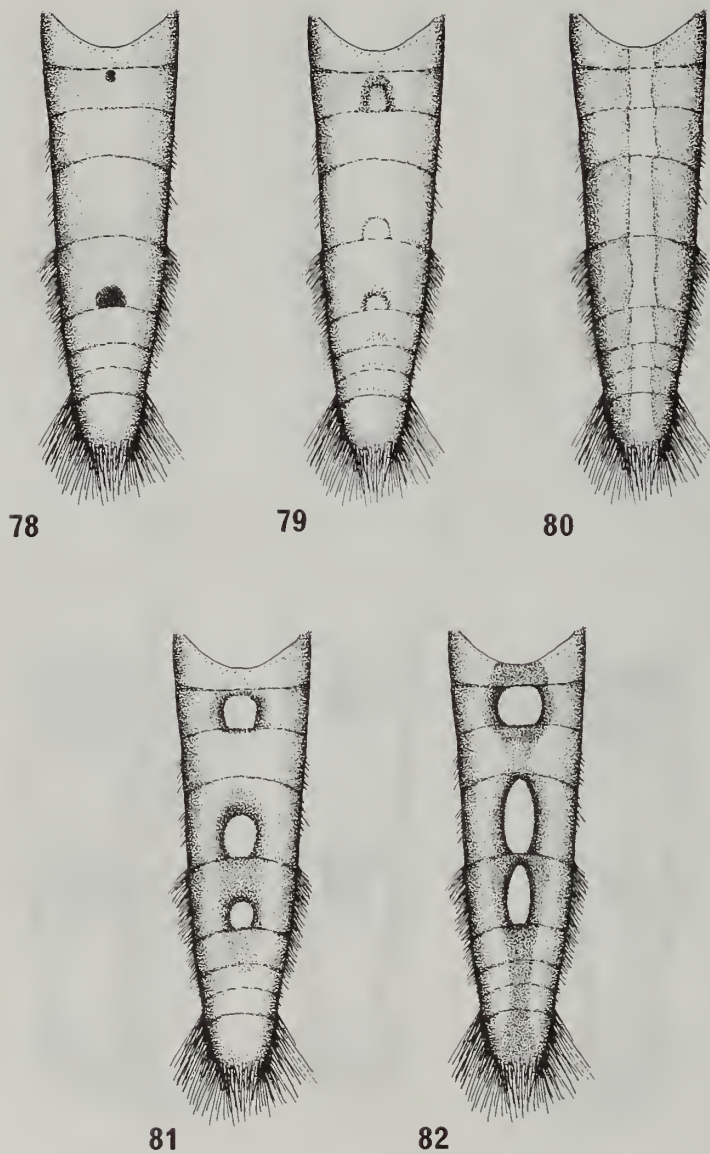
Figs 53–67 *Nemoria* species. 53, *N. marianellae*. 54, *N. isabelae*. 55, *N. dentilinea dentilinea*. 56, *N. toxeres*, ♀. 57, *N. nympharia*. 58, *N. venezuelae* (form B). 59, *N. florum*, ♀. 60, *N. defectiva*. 61, *N. acutularia*. 62, *N. gladyssae*. 63, *N. franciscanae*. 64, *N. agenoria*. 65, *N. callirrhoe*. 66, *N. priscillae*. 67, *N. adaluzae*. Moths are Costa Rican males unless stated otherwise. Scale line = 10 mm.



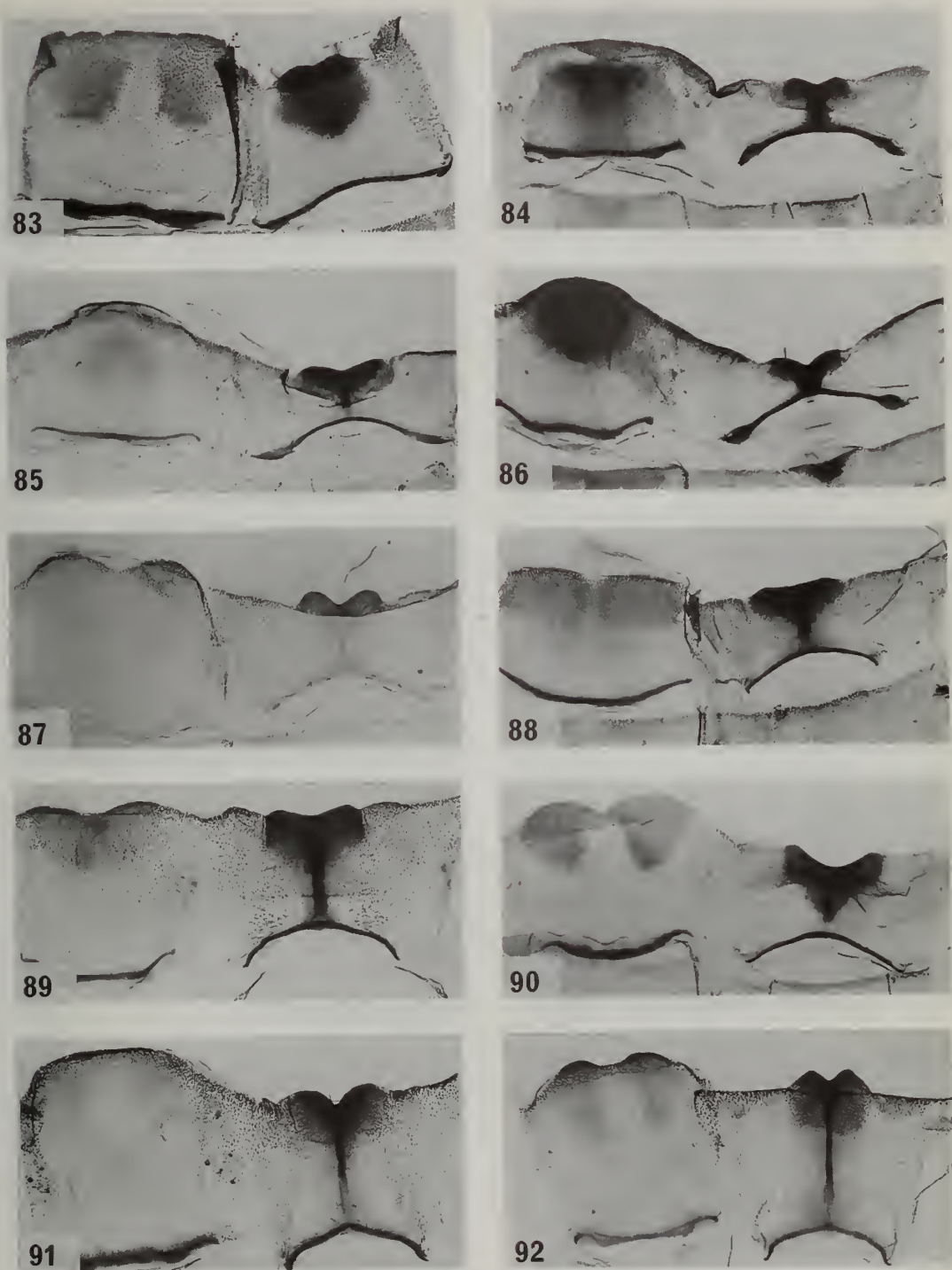
Figs 68-71 68, 69, wing venation of *Nemoria* species. (68) *N. remota*. (69) hind wing of *N. astraea*. 70, 71, dorsal markings of abdomen, based on males. (70) *Chavarriella porcius*. (71) *Lissochlora ronaldi*. The markings are shown on a standardised abdomen plus metathorax.



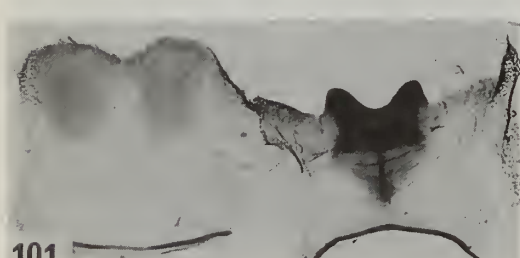
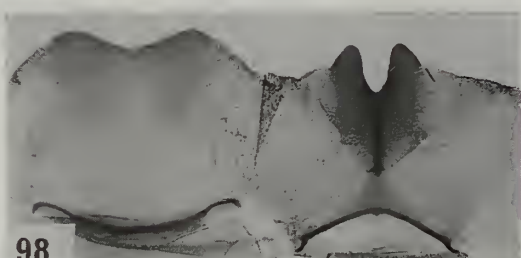
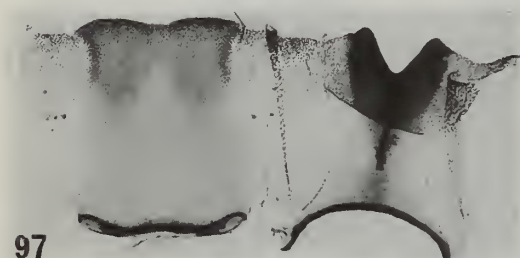
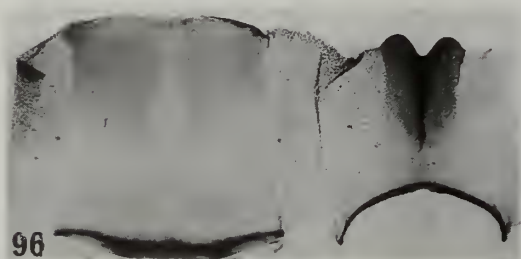
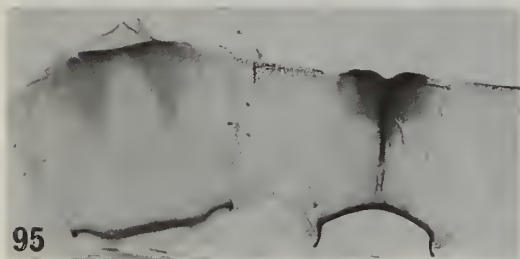
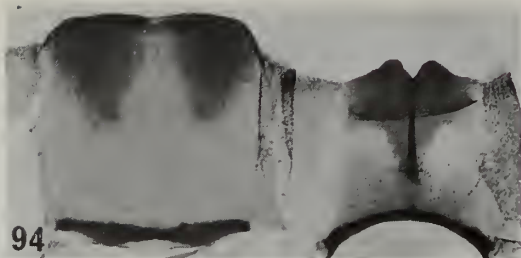
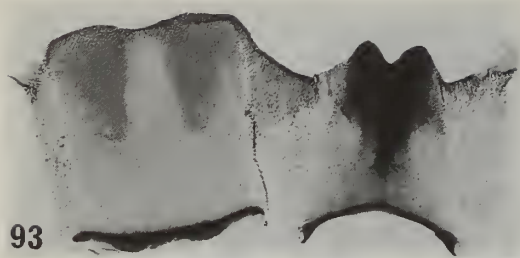
Figs 72–77 Dorsal markings of abdomen of *Nemoria* species, based on males. 72, *N. adjunctaria*. 73, *N. tickelli*. 74, *N. karlae*. 75, *N. rectilinea*. 76, *N. pacificaria*. 77, *N. carolinae*. The markings are shown on a standardised abdomen plus metathorax.



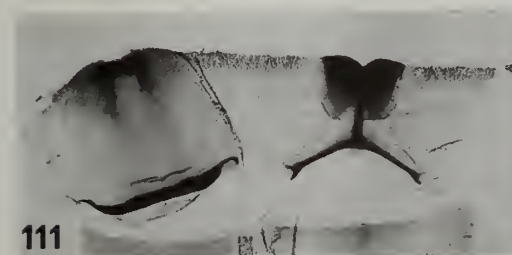
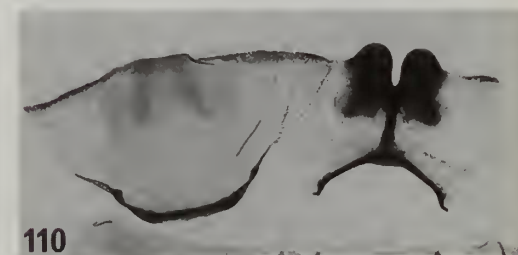
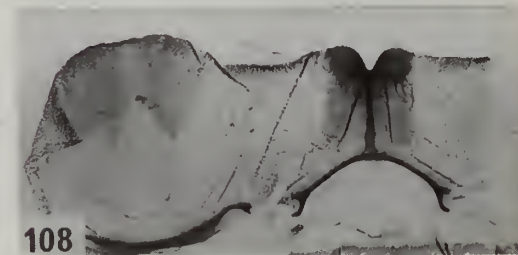
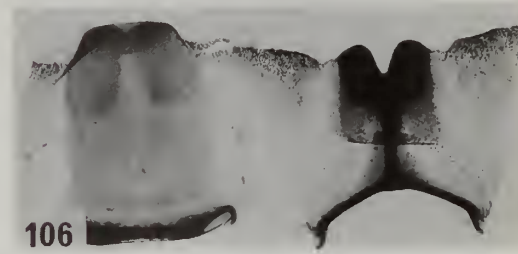
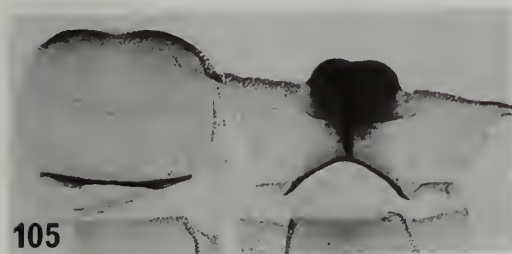
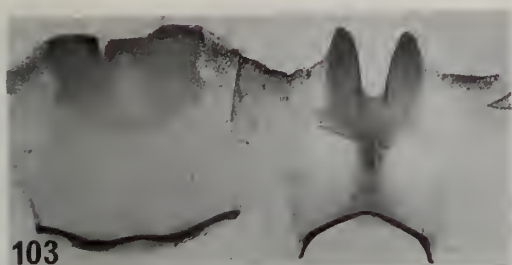
Figs 78–82 Dorsal markings of abdomen of *Nemoria* species, based on males. 78, *N. punctilinea*. 79, *N. defectiva*. 80, *N. dorsilinea*. 81, *N. toxeres*. 82, *N. winniae*. The markings are shown on a standardised abdomen plus metathorax.



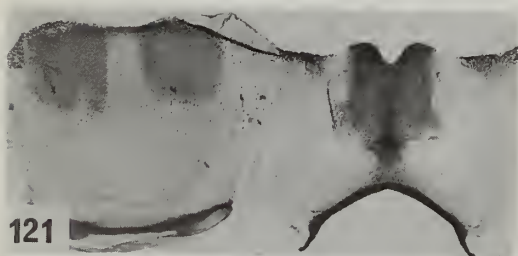
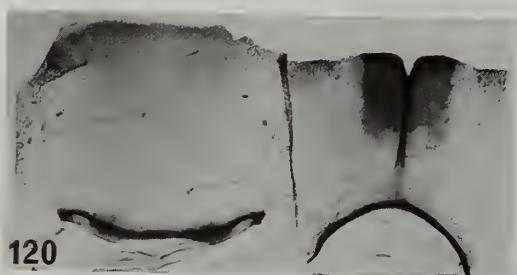
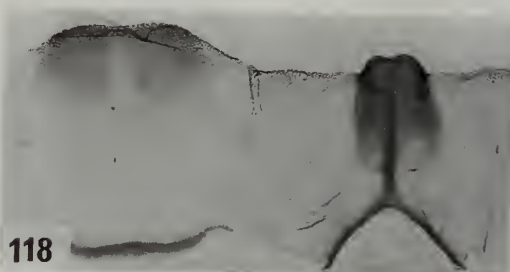
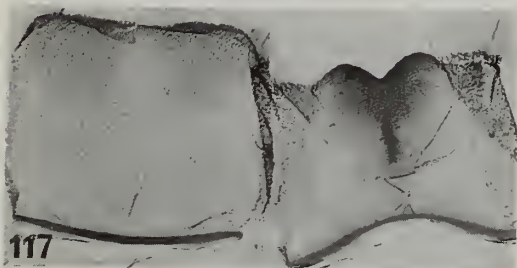
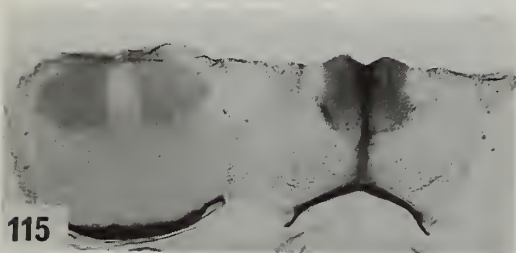
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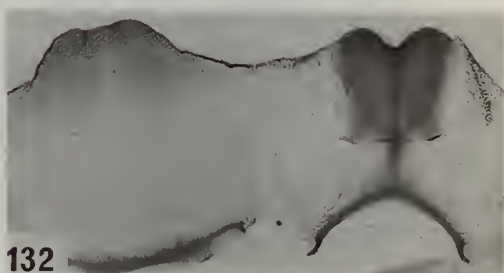
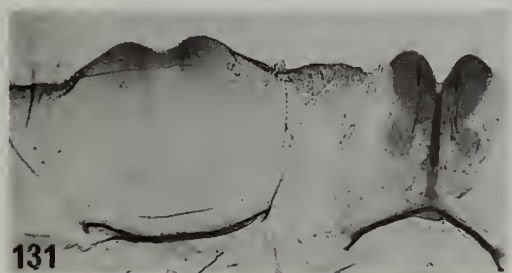
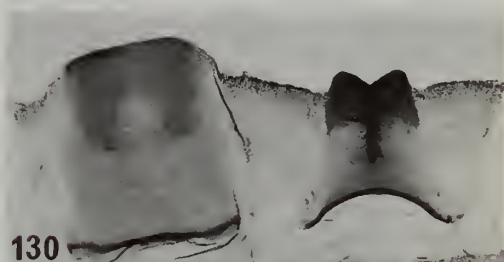
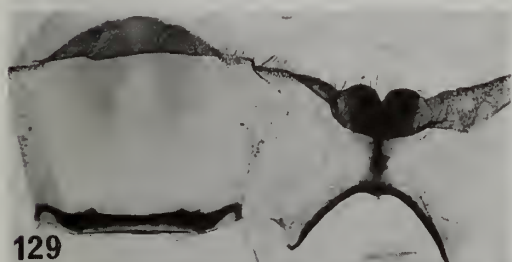
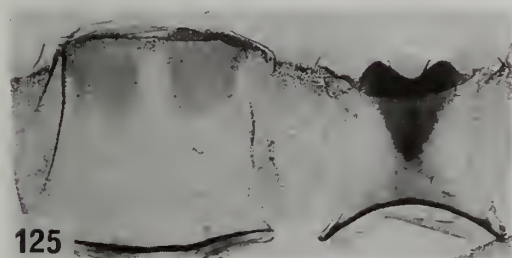
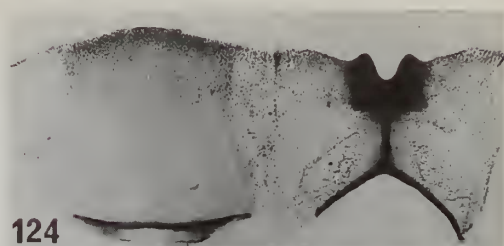
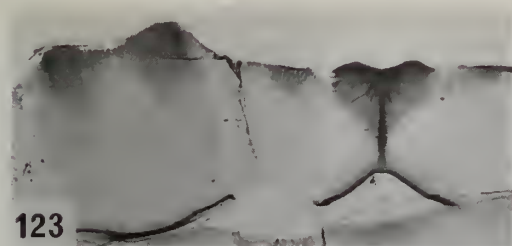
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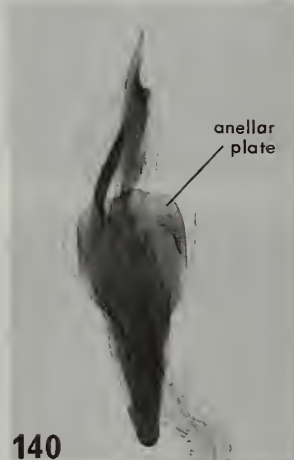
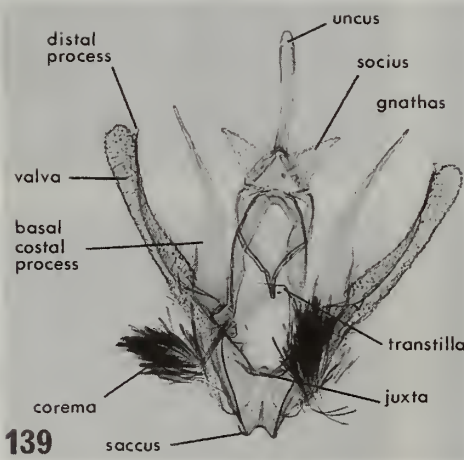
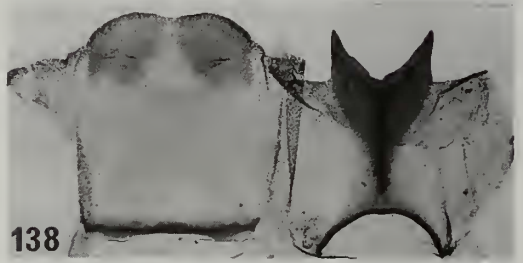
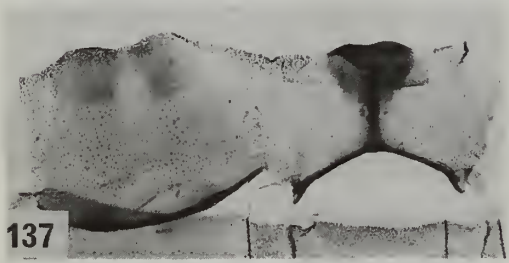
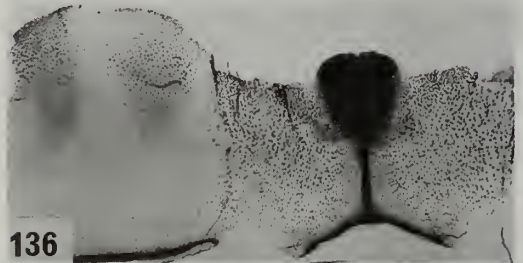
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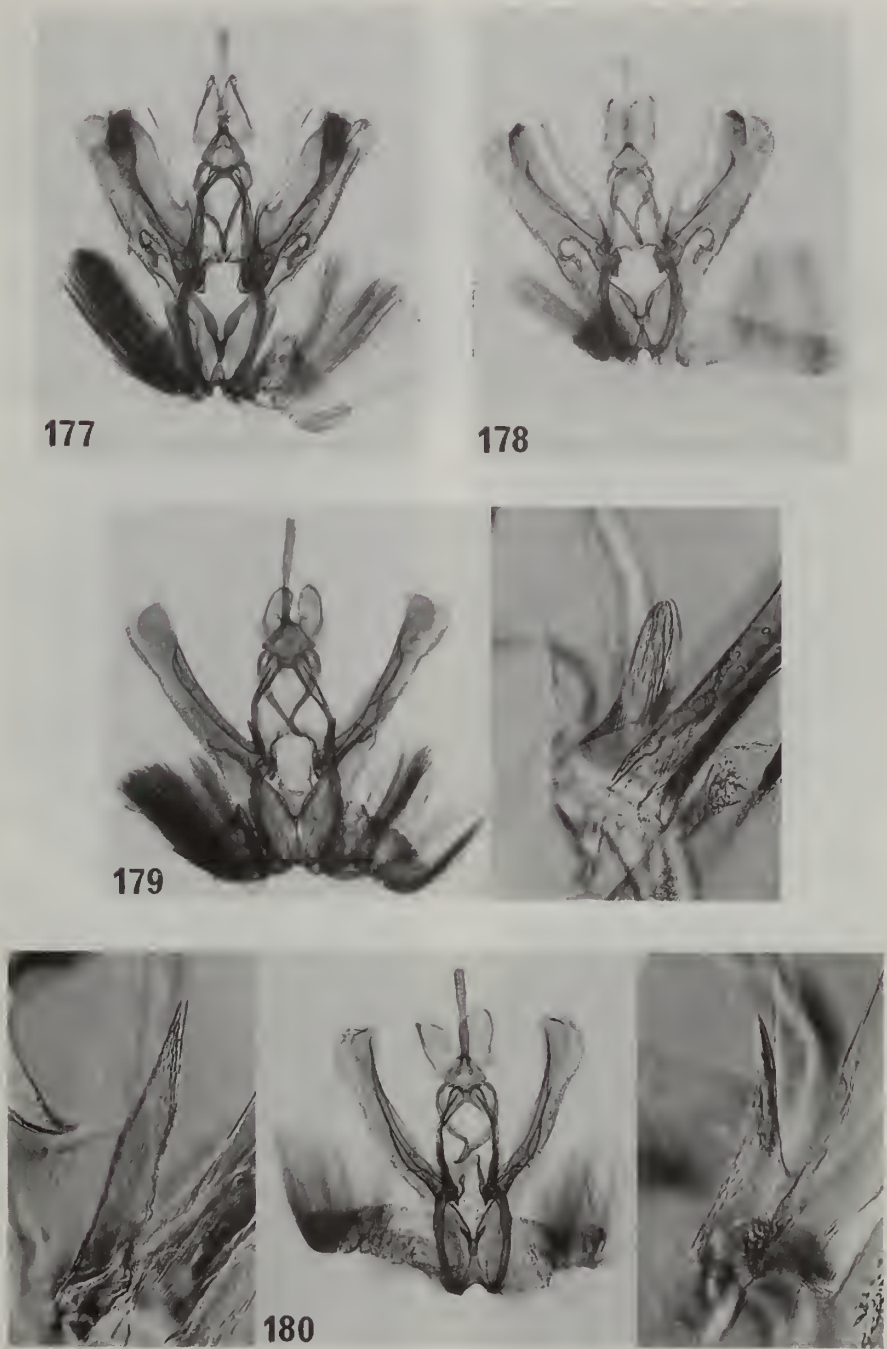
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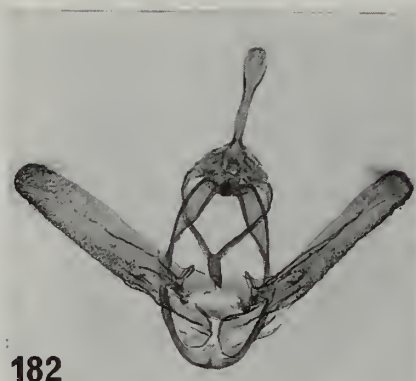
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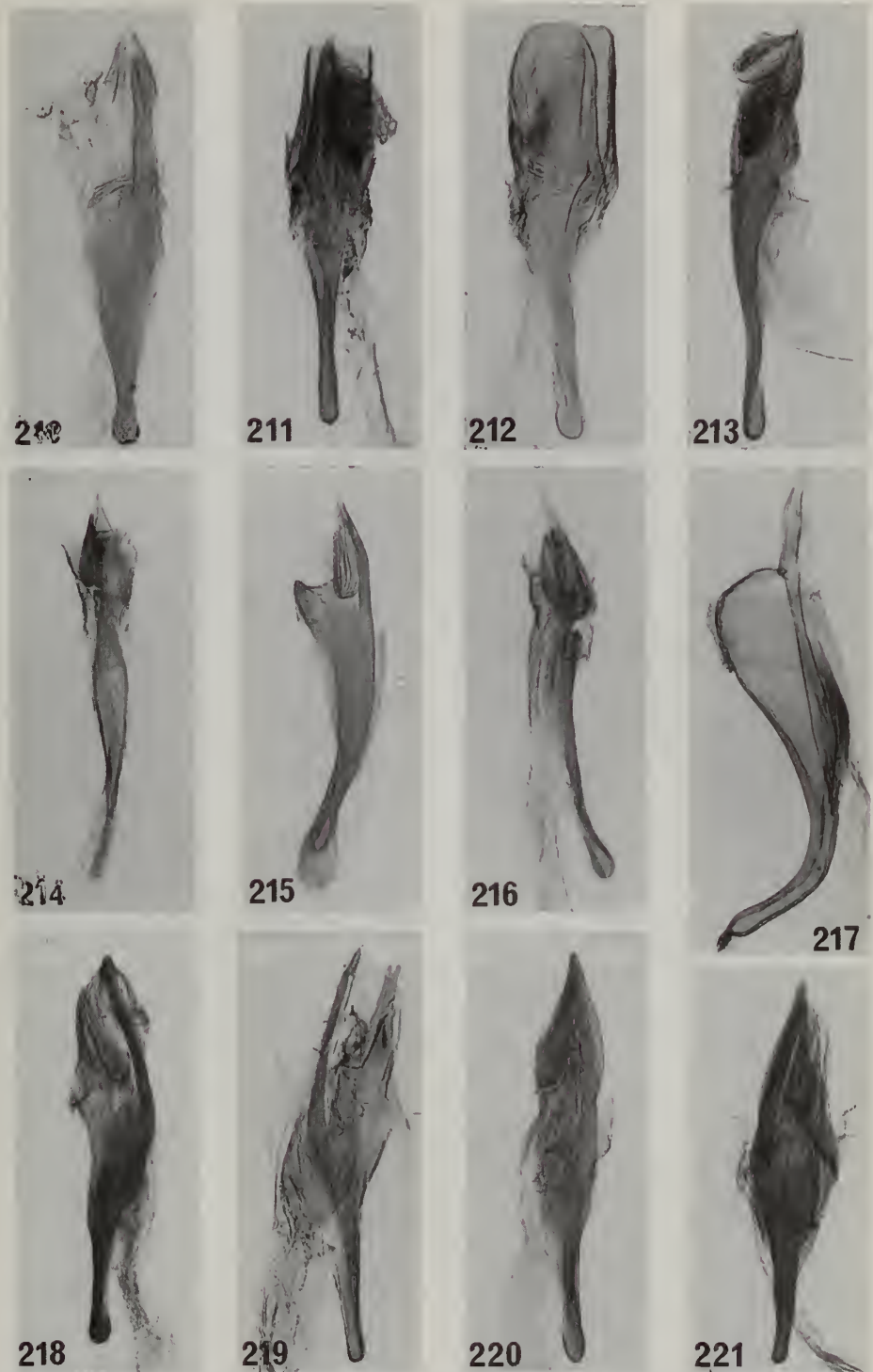


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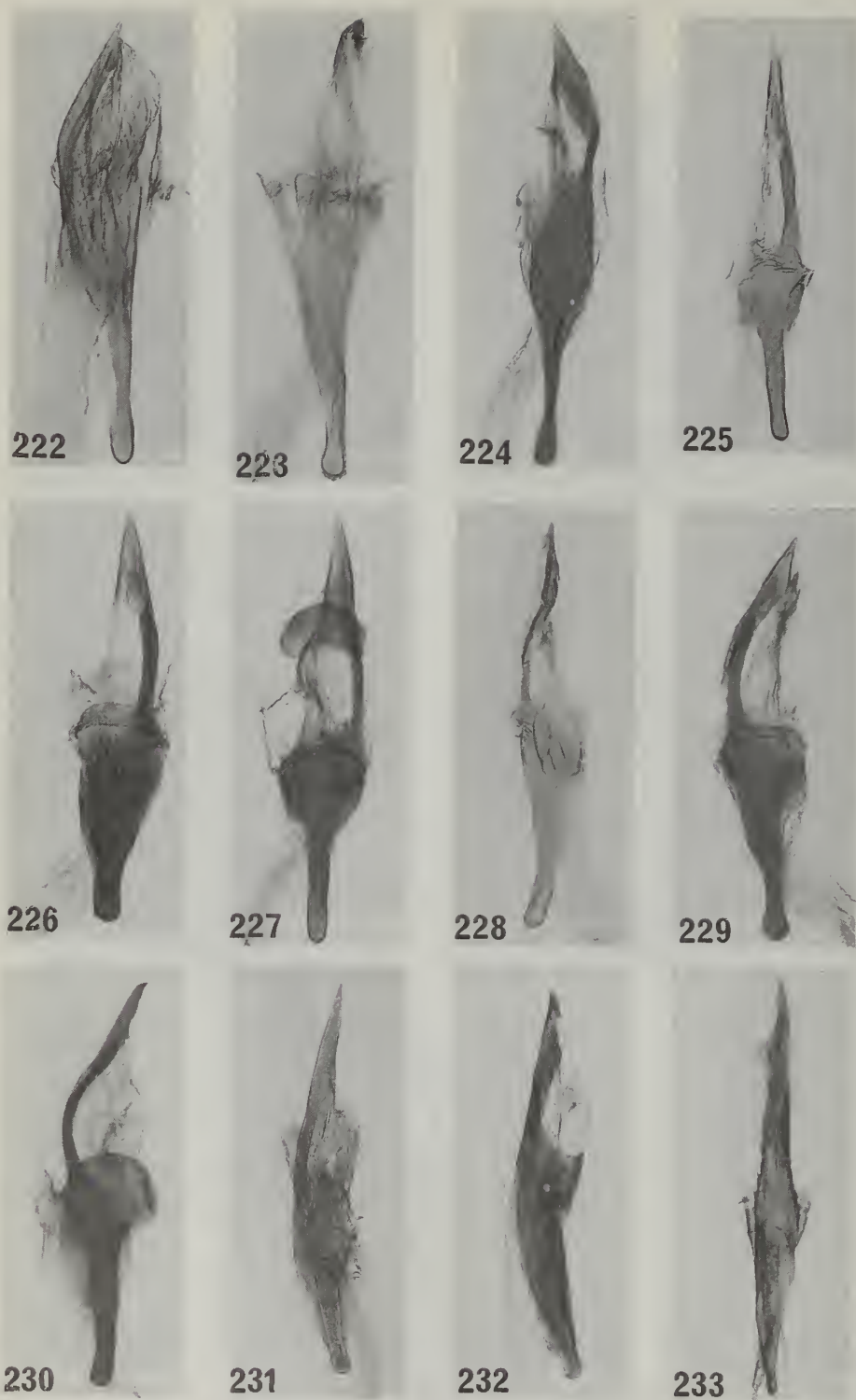


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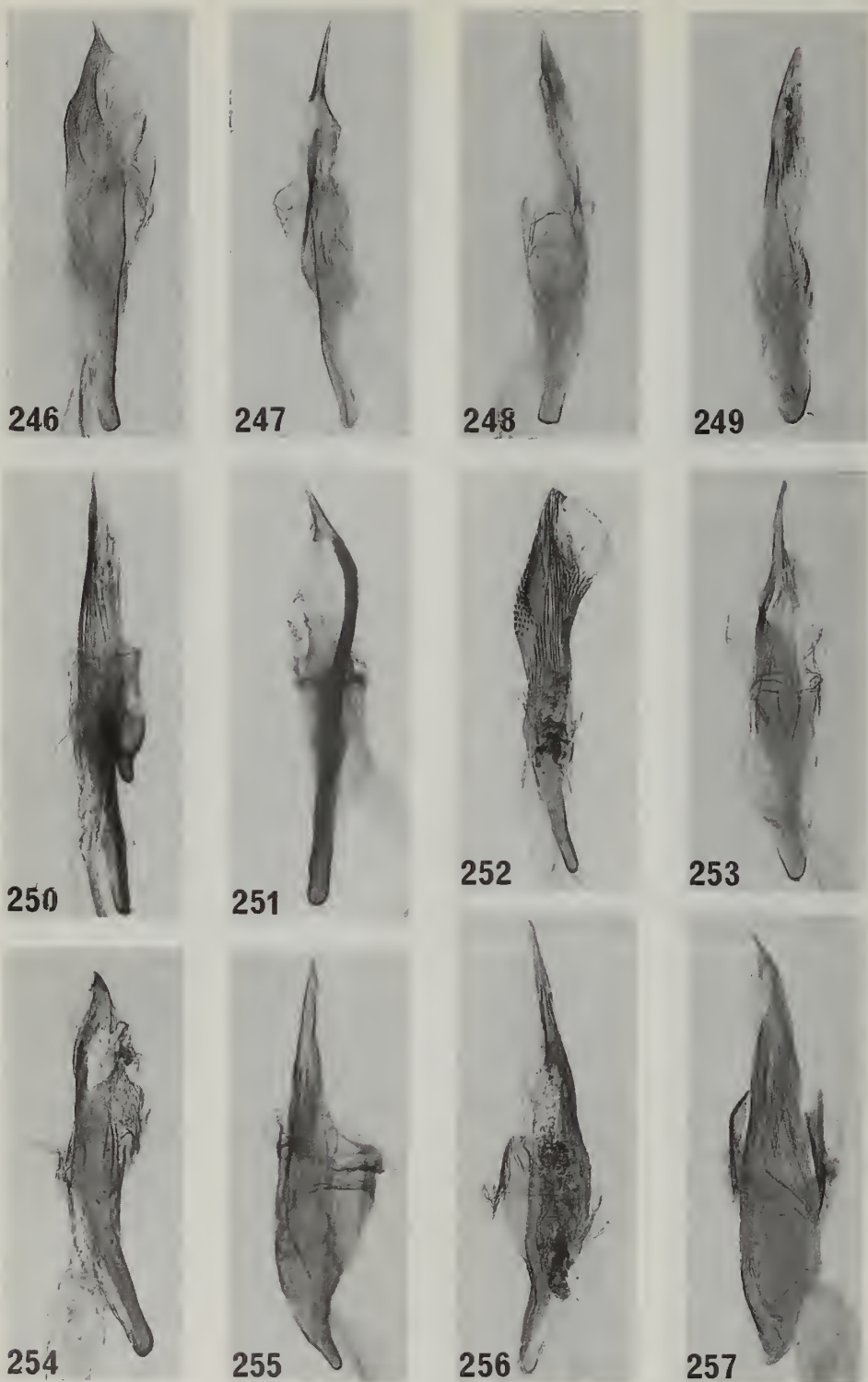
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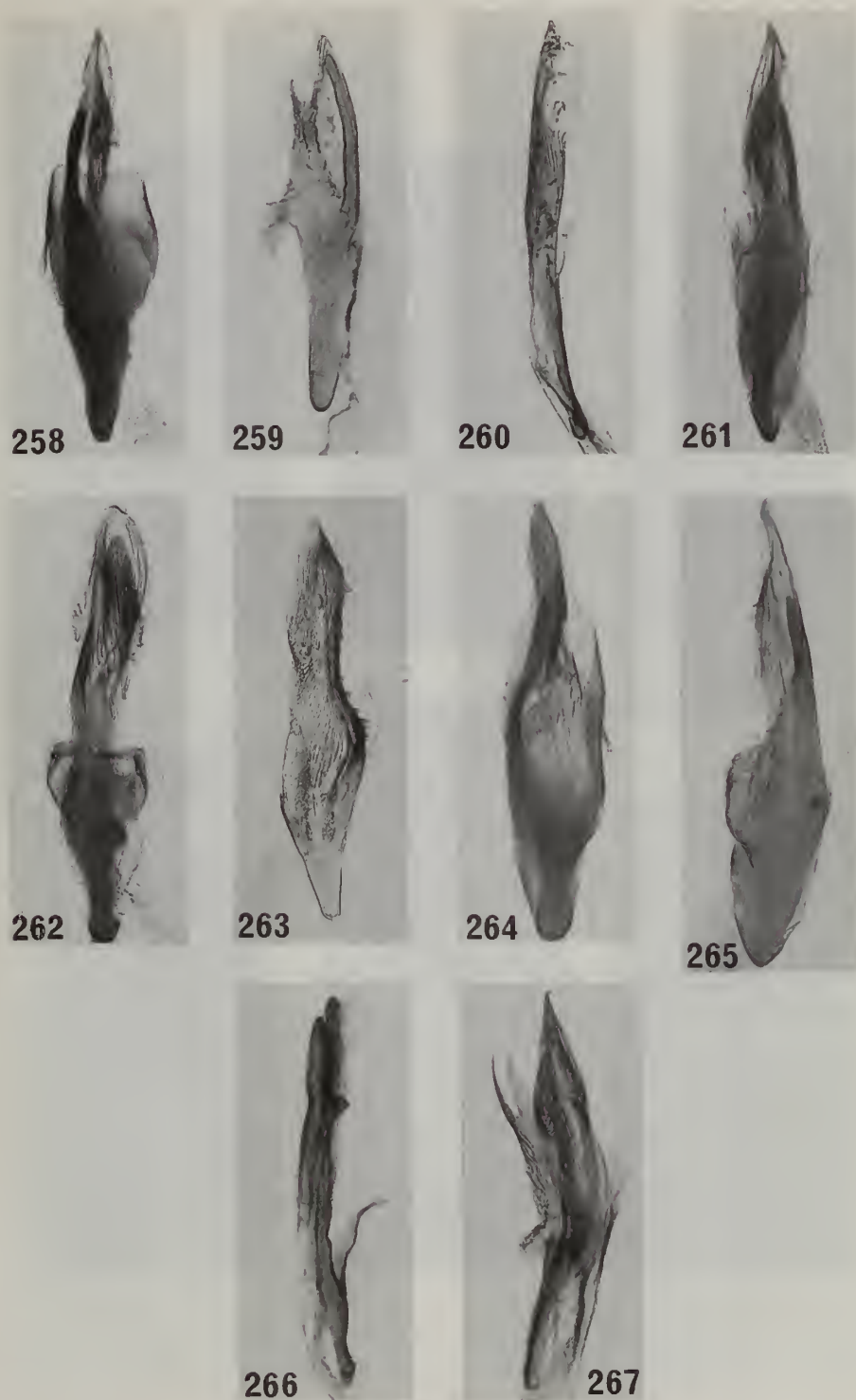
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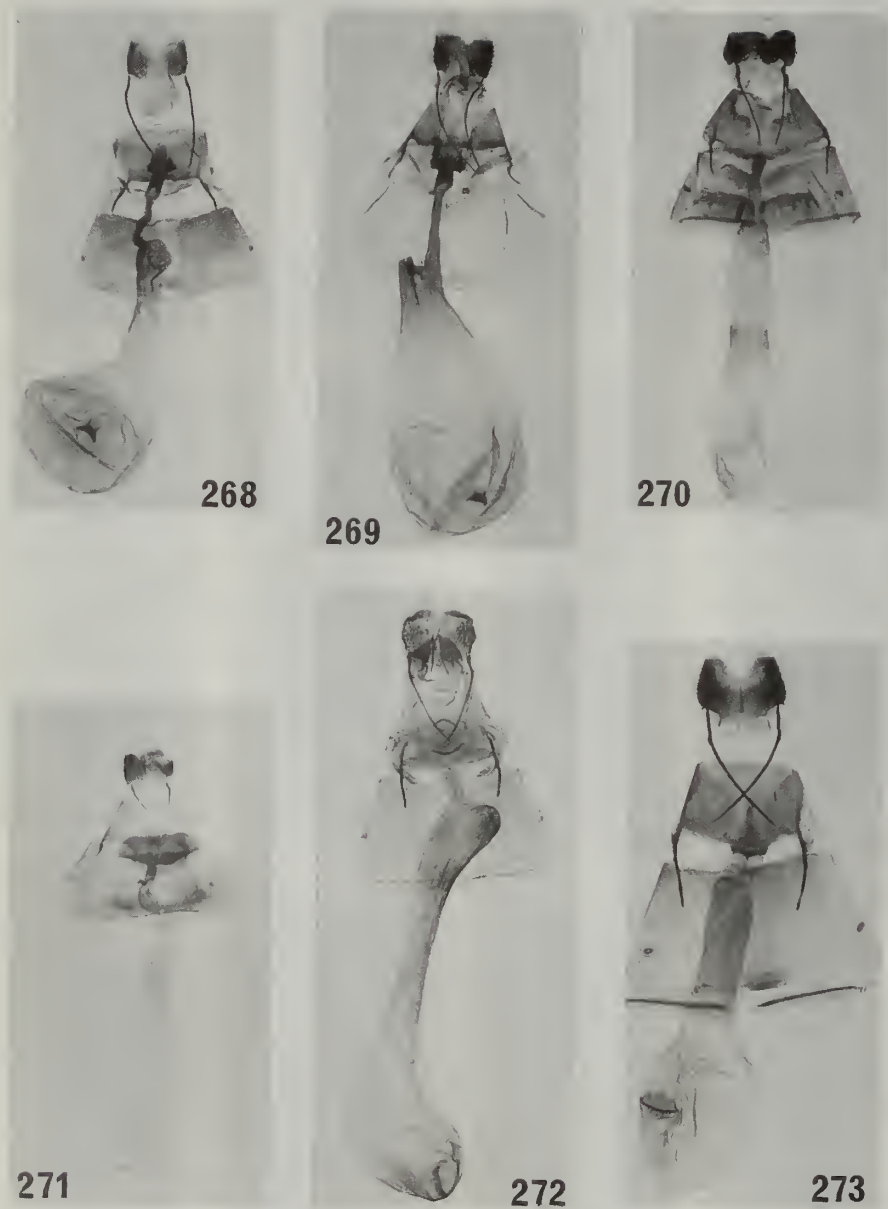
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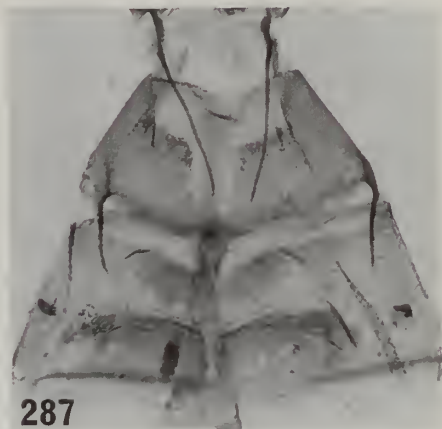
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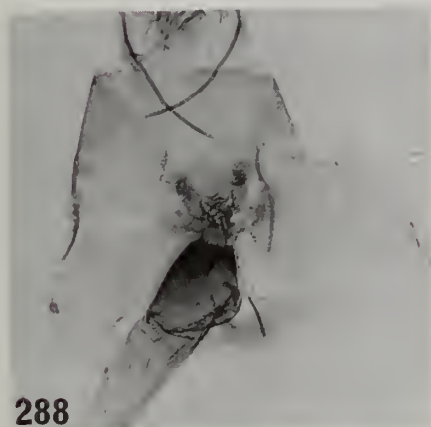
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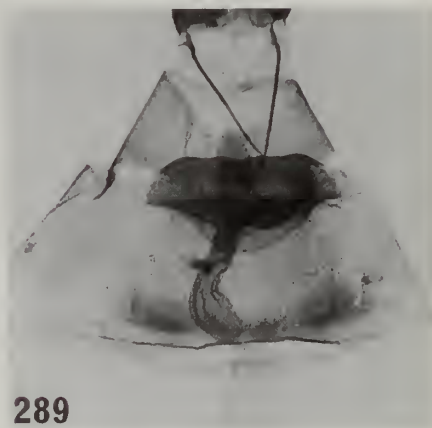
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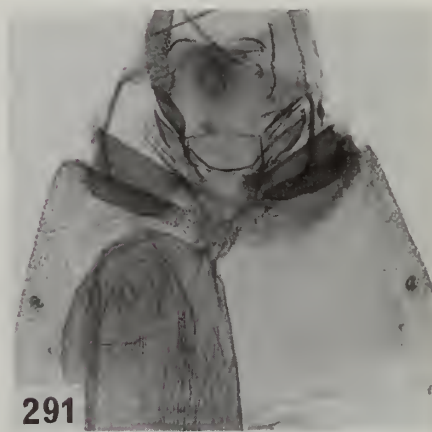
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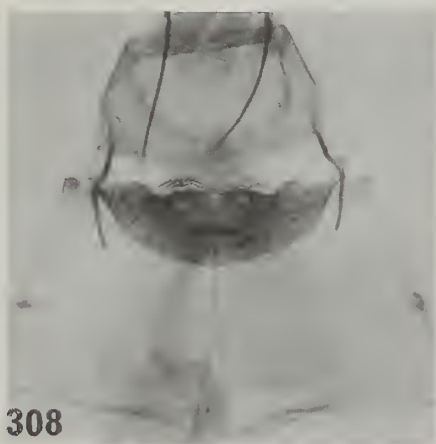
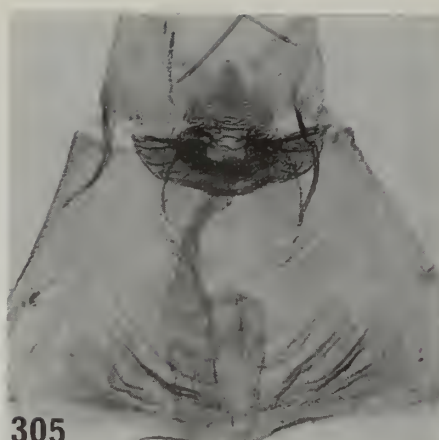
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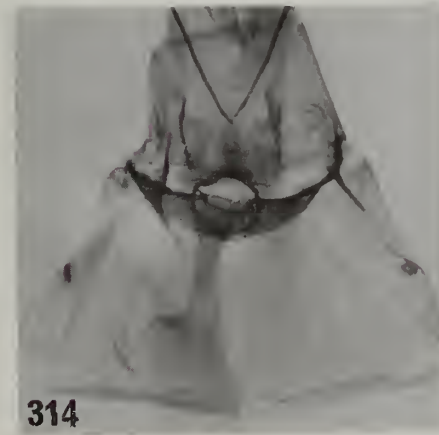
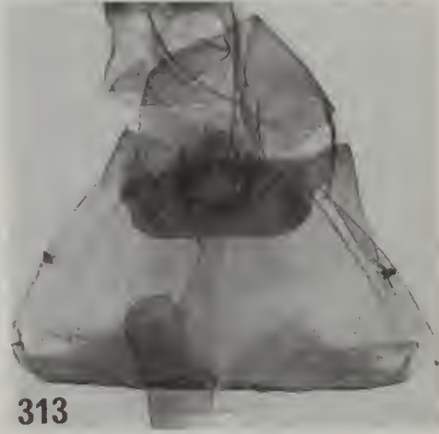
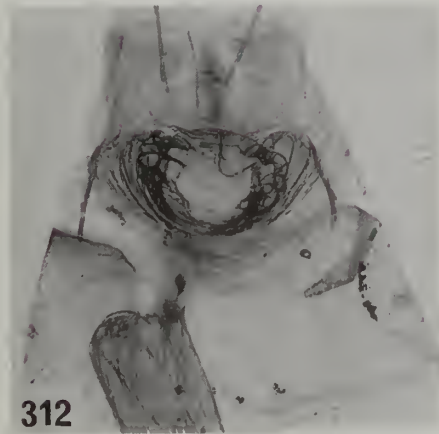
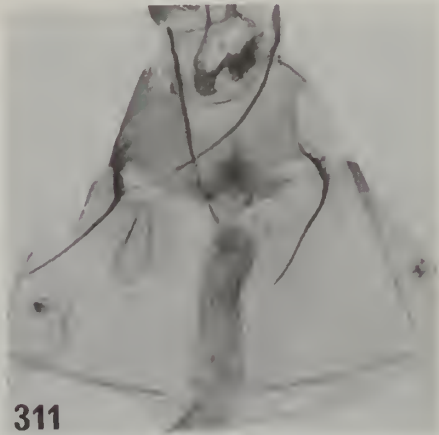
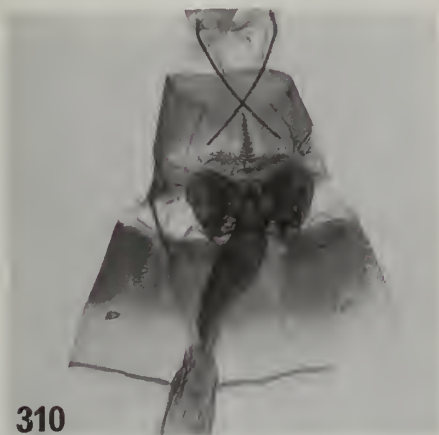
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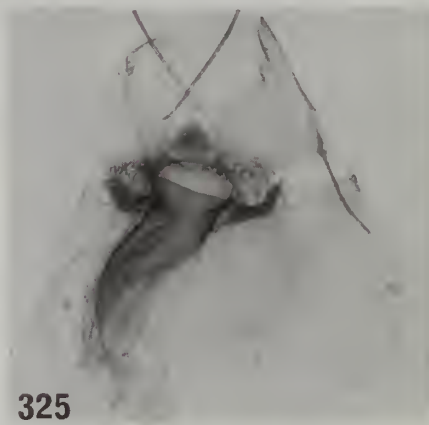
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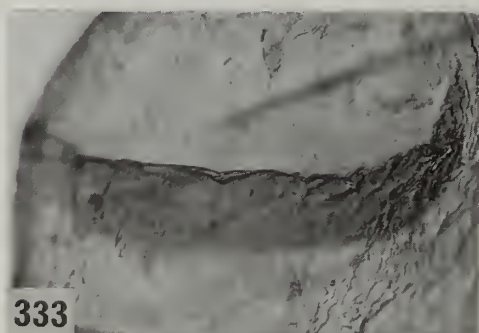
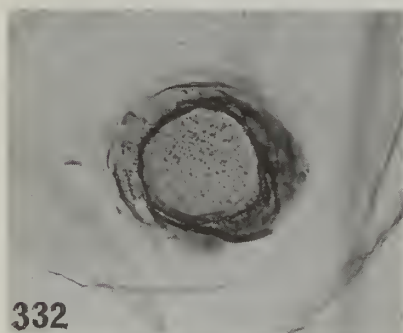
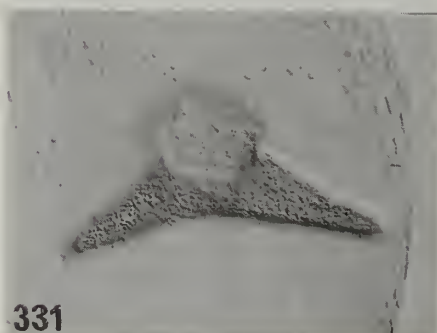
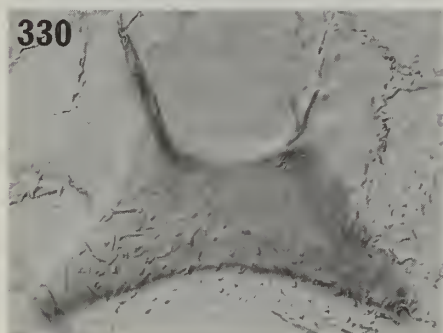
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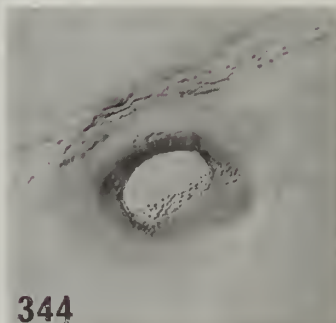
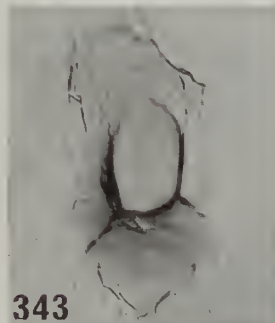
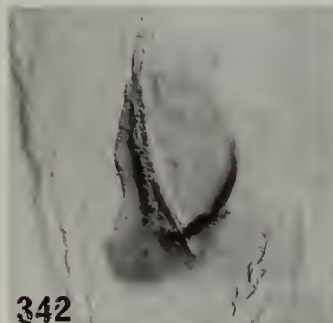
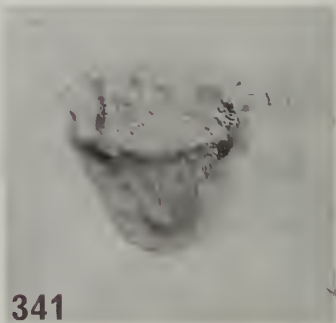
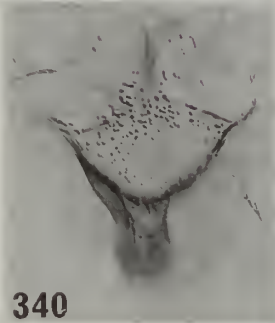
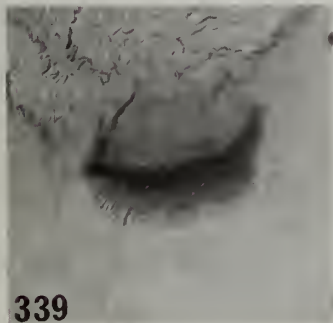
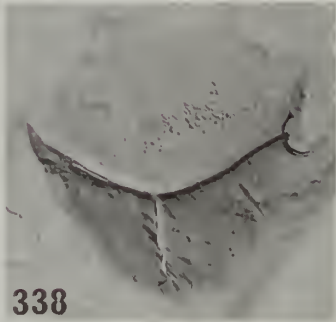
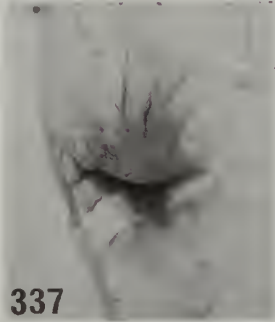
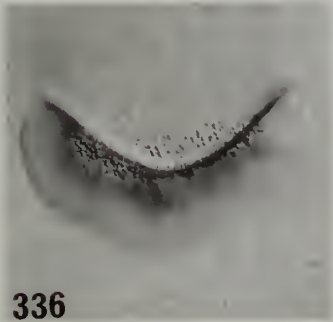
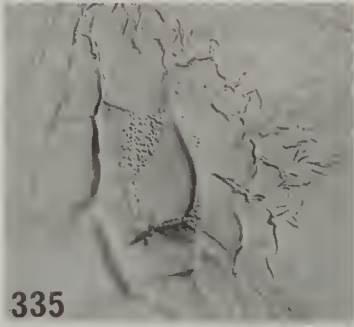
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